SCIENCE

FRIDAY, MARCH 22, 1912

CONTENTS

Investigations of the Carnegie Institution .. 437

Charles X. Dalton: GEO. W. ROLFE 444

The Second International Congress of Entomology 446

Antarctic Explorations 447

Scientific Notes and News 447

University and Educational News 451

Discussion and Correspondence:—

Number of Students per Teacher: JOSEPH PETERSON. *Are Teachers entitled to Complimentary Desk Copies of Technical Works:* DR. V. KARAPETOFF 452

Scientific Books:—

Brown's Melanesians and Polynesians: DR. WALTER HOUGH. *Hurter on the Herpetology of Missouri:* RAYMOND L. DITMARS .. 454

A Remarkable Journey across the Sahara: DR. W. A. CANNON 455

Botanical Notes:—

Supplement to Engler and Prantl's Algæ; Notes: PROFESSOR CHARLES E. BESSEY ... 456

Special Articles:—

The Accumulation of Oil and Gas in Sandstone: DR. ROSWELL H. JOHNSON 458

The American Society of Zoologists: PROFESSOR JOHN H. GEROULD 459

The American Institute of Chemical Engineers: DR. J. C. OLSEN 475

MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

INVESTIGATIONS OF THE CARNEGIE INSTITUTION[1]

THE past fiscal year has been, on the whole, the most fruitful year on record for the ten specially organized departments of research in the institution. Although some of these are not yet fully equipped, they are all so well organized and provided for that their energies may now be chiefly directed to the attainment of definite results.

A development of much interest in connection with these departments is that of cooperative effort coming through research associates and collaborators. The departmental facilities are already in considerable demand from capable investigators, and many of them are found desirous of using these facilities, not only to forward their own researches, but to collaborate in the researches proper of the departments. The favorable experience which has accrued in recent years in these matters indicates that it may be advantageous in the future to seek to secure an additional number of investigators who, by reason of their eminence, may collaborate effectively in this manner.

Each of these departments has now under way such a variety and complexity of work that it is difficult to summarize. Reference must be made, therefore, for matters of detail, to the reports of the directors of the departments, published in full in the current year book. Hence such allusions in the following paragraphs as are made to the progress of the year are necessarily brief and can deal only with the more salient

[1] From the Report of the President, Dr. R. S. Woodward, for the year 1911.

aspects of departmental affairs and researches.

DEPARTMENT OF BOTANICAL RESEARCH

The activities of this department now necessarily cover a wide range, since any successful attempt to solve the problems of the origin, development, migration, and modification under varying climatic conditions of plant life must require extensive field observations, much laboratory experimentation, and increasing application of the sciences of chemistry and physics. It is natural and proper, therefore, that the staff and collaborators of the department should include many specialists, and that they should approach the problems to be investigated from many points of view. Thus it happens that the investigations of the past year have embraced, among others, studies of the evaporation, the increasing salinity, and the changes in vegetation following close after the receding shores of the Salton Sea; of the influences of temperature, rainfall, sunlight, soil-moisture, etc., on plant organisms; of the effects following transplantation from low to high altitudes and from arid to humid localities; of the variations in water and acid content of plants; of the chemical effects induced in plant tissue by light and heat; and of the physiological functions of leaves in plant life.

One of the most interesting investigations under way during the year is that of Dr. Ellsworth Huntington, research associate of the department, on the secular variations of climate of the southwest desert area in recent geologic time. From this work it is believed that some of the salient fluctuations in climate during the past two or three thousand years may be clearly made out. Another noteworthy investigation of the year is that of the respiration of cacti, undertaken by Professor H. M. Richards in collaboration with the department. This has developed the remarkable fact of a definite diurnal periodicity in the acid content of the sap of the cacti under observation. The progress and status of many other instructive investigations are set forth at length under the twenty subdivisions of the director's report, to be found in full in the current year book. From this it appears that, in addition to the regular and associate members of the staff of the department, about an equal number of individual investigators have collaborated in the researches under way. Special attention may be here invited to the detailed account given in one of the subdivisions of this report by Professor Tower in reference to his further experiments on the evolution of chrysomelid beetles, the results of his early work in this line under the auspices of the institution having been issued as publication No. 48.

DEPARTMENT OF EXPERIMENTAL EVOLUTION

It is a well-known fact that important generalizations in science usually leave a multitude of details to be worked out. Indeed, advances often raise more questions than they settle. Such has been the wonderfully fruitful effect of the doctrine of evolution propounded by Darwin, Spencer, and Wallace a half century ago. It should not be surprising, therefore, that the program of the Department of Experimental Evolution presents a considerable variety of investigations related to the highly complex problem of heredity chosen by the director as the principal object of research. Thus the work of the year includes investigations of heredity in plants, insects, birds, animals, and man.

One of the most promising investigations of the year is that of the director in reference to the heredity of epileptics. Through his connection with the Eugenics Record Office, he has collaborated with Dr. David

F. Weeks, of the New Jersey State Village of Epileptics, and secured a large quantity of accurate statistical data bearing directly on this disorder. From these data it appears not improbable that important practical deductions may be presently, if not already, drawn. Another investigation continued during the year, which involves prime utilitarian application, is that of Dr. Shull on the effects of self-fertilization in maize, or Indian corn. His earlier conclusions, published in 1908, have been confirmed by the later studies. A striking result from the latter is that, other conditions being the same, the yield of cross-fertilized plants proved fifty per cent. greater than that of the self-fertilized plants. Observational and experimental work has been carried on also along many other lines. The total number of zoological individuals under study exceeded 2,000, while the range of plants observed included nearly 500 species and upwards of 40,000 individuals.

DEPARTMENT OF ECONOMICS AND SOCIOLOGY

The diversified work of this department has proceeded during the year in accordance with the plan approved by the executive committee in May, 1910, which contemplated completing the researches then under way as well as might prove practicable under the limitations of the balance of appropriations previously made to the department. A full statement of these appropriations, of the expenditures under them to date, and of the present available balance, will be found in the section of this report devoted to the proposed budget for the ensuing year.

As explained at length by the chairman of the department in his report, to be found in the current year book, progress in the work under way is necessarily slow, since the heads of the divisions of research and most of their collaborators are primarily engaged in other occupations. But in spite of this handicap, inherent in the organization, much work has been accomplished, and the chairman reports that several of the heads of divisions are now engaged on their final reports.

DEPARTMENT OF HISTORICAL RESEARCH

The eighth annual report of this department, and the sixth of the present director, is an instructive record of effective progress along all lines of work thus far undertaken to discover and to render available the sources of American history. Members of the department have been engaged during the year searching the archives of Great Britain, France, Spain, and Mexico, as well as those of the United States, for all accessible data, and these are being rapidly put in form for publication in convenient manuals. Three such works have been published by the institution during the past year, namely, "Guide to the Materials for American History in Roman and other Italian Archives"; "Inventory of Unpublished Material for American Religious History in Protestant Church Archives and other Repositories"; and "Calendar of Papers in Washington Archives relating to the Territories of the United States." The following are now in press: "Guide to the Manuscript Material relating to American History in the German State Archives" and "Guide to Materials for the History of the United States in the Principal Archives of Mexico."

It is worthy of remark that the results of this department's activities have received very general commendation from professional historians in Europe as well as in America. The ten manuals thus far issued are already much in demand in foreign countries, and they seem destined to become

as important in aggregate usefulness abroad as at home. It is hoped that the institution may be thus enabled to render adequate acknowledgment for numerous courtesies extended to the department by officials of governments, archives, libraries, and other establishments.

GEOPHYSICAL LABORATORY

The signal success already attained by this laboratory leaves no reason for doubt as to the practicability of continued advances toward solution of that large and difficult group of chemical and physical problems presented by the materials of the earth's crust. The current report of the director reviews twenty-six papers which have been issued by members of the staff of the laboratory during the year. Among these papers is a noteworthy contribution to general physics, in which the scale of precise thermometry is extended by 1250° C. This extension was an essential incident to the studies of mineral fusion, crystallization, etc., carried on in the laboratory, but it is of equal importance to other branches of physical research. Another noteworthy paper is a preliminary contribution to the long-standing question of the constitution of Portland cement. The complexity of this substance proves to be far greater than hitherto supposed; but its general characteristics have been determined and the resources of the laboratory are adequate to complete the remaining quantitative details of the investigation.

International appreciation of the work of the institution is now shown in many ways. The merits of the researches of the geophysical laboratory have been more promptly recognized, indeed, than its projectors anticipated. Thus nearly all of the preliminary papers issued by members of the staff of the laboratory have been published in German as well as in English, and arrangements have been made during the past year to have all such papers appear contemporaneously in both of these languages.

Of numerous investigations under way at the laboratory, attention may be called here to some preliminary studies of an active volcano, which indicate that the phenomena of vulcanism are within range of practicable determination and that progress in this direction is only a question of time and adequate effort.

DEPARTMENT OF MARINE BIOLOGY

In addition to the research work proper carried on by the director of this department during the year, much of his time and attention have been devoted to the construction of a new vessel and to the reconstruction of the laboratory at Dry Tortugas. Reference to this vessel, named the *Anton Dohrn*, has been made in a previous section of this report, and a description of her characteristics and equipment will be found in the current report of the director. It may suffice here, therefore, to state that this adjunct gives the department independent and adequate transportation facilities and greatly enlarged opportunities for marine research.

Mention was made in my report of a year ago of the probable damage done to the Tortugas laboratory by the destructive hurricane which swept the Florida Keys October 17, 1910. An inventory of the wreckage was made as soon as practicable, and it was found that an expenditure of $4,000 would be essential to renew the establishment in a safe and effective manner. Accordingly, an allotment of this amount from the insurance fund of the institution was made by the executive committee at its meeting of November 17, 1910, and the wrecked buildings have been replaced during the past summer by struc-

tures at once more secure and more commodious.

On account of lack of quarters the director has been able to afford facilities for research at the laboratory to only eight investigators. Nevertheless, the year has proved fruitful in important advances. One of these, attained by Mr. G. H. Drew, of Cambridge University, relates to the rôle of certain bacteria in depriving surface sea water of nitrogen and in precipitating the vast deposits of chalky mud (oolite) of the Florida-Bahama region; another, by Dr. T. W. Vaughan, records definite progress in his quantitative determinations of the growth of corals and coral reefs; while the director and his collaborators have published twenty-one papers, mostly included in volumes Nos. 132 and 133 of the publications of the institution.

DEPARTMENT OF MERIDIAN ASTROMETRY

As already explained in a preceding section of this report, the meridian determinations of stellar positions at the temporary observatory at San Luis, Argentina, were finished in January, 1911. This completion in an unexpectedly short time of the more formidable part of the undertaking of the department in the southern hemisphere leaves only the minor task in photometry of measuring the magnitudes (or brightness) of those stars for which this property has not been hitherto measured. This task, requiring only two observers and light equipment, will be subject to small expense.

In the meantime the deductions of stellar positions and motions are proceeding expeditiously in the computing section of the department at the Dudley Observatory; so that the final catalogue, giving precise positions of all stars up to the seventh magnitude inclusive, may be expected to appear in due time. As often happens in such extensive scientific investigations, many by-products are arising of hardly less importance than the primary ends in view. One of these, deduced from the director's preliminary Star Catalogue, published by the institution about two years ago, shows the mean velocities relative to the solar system of stars of different spectral types. The values derived from the "proper motions" of the catalogue are in striking agreement with those derived for the same stars by Professor W. W. Campbell from direct measurements of the motions of these stars in the line of sight. The remarkable result which is thus brought out from independent investigations is that the speed of a star through space increases with its age. Attention is here invited to the director's interesting summary of this by-product in his current report, the investigation in full having been published in the *Astronomical Journal,* April 3, 1911. It is of interest to note in this connection that the independent investigations of Campbell, referred to above, were also carried out by aid of grants made by the institution.

NUTRITION LABORATORY

Allusion has been made frequently in previous reports to a prime characteristic in the progress of all of the more highly developed sciences. This consists in the passage from the stage of observation and experiment to the stage of measurement and calculation, or in the transition from the stage of qualitative to that of quantitative knowledge. It is marked by the introduction of the meter, the balance, the thermometer, the telescope, the microscope, etc., and the definite methods of chemistry and physics. The development of the work of the nutrition laboratory affords a capital illustration of this characteristic mode of procedure, and therein we find also the best

justification for confidence in the enterprise.

The staff of the laboratory has been occupied during the year in the construction of new apparatus, in the improvement of apparatus already in use, in numerous researches on pathological and normal subjects, and in the preparation and publication of reports on results already attained. The year has shown also a remarkable increase of interest in the work of the establishment coming especially from members of the medical profession at home and abroad. Several of these have collaborated very effectively in the experiments under way, and the widely general approval of the objects and methods of the laboratory insures the heartiest cooperation from experts in the closely allied fields of physiological and pathological research.

The numerous investigations in progress and the publications issued during the year are reviewed in interesting detail in the director's report. Of the nine publications issued, one (No. 155 of the institution) gives the results of an important study of the variations of temperature in different parts of the human body. Of equal popular and technical interest also are the results, recorded in another paper, of experiments on men to determine the effects of breathing air rich in oxygen content.

THE SOLAR OBSERVATORY

By reason of the absence on leave of Professor Hale, the varied work of this observatory has been in general charge of Mr. Walter S. Adams, who, as acting director, has prepared the report of progress for the past fiscal year as well as that for the year 1909–1910. Quite fortunately the affairs of the observatory have proceeded without serious delay during Professor Hale's absence, and it is gratifying to announce that his health was so far restored as to permit him to return to his duties October 1, 1911.

Although the construction and equipment of the observatory are still incomplete, the members of the staff are making rapid progress with their programs of solar, stellar, and physical observation and of computation and deduction. Thus the attainment of tangible results proceeds along with the development and installation of equipment. Attention is invited to a list of such results, attained during the year, cited in interesting detail by Mr. Adams in his report, but too long for an abstract in this place. It need only be said of them here that they justify expectations and that they increase confidence in the capacity of the establishment to advance astrophysical science.

The observatory has now, nearly fully equipped and in use, four highly effective telescopes: the Snow, horizontal, 30-inch reflector; the two tower-telescope refractors; and the 60-inch reflector mounted equatorially. The 150-foot tower telescope, together with its auxiliary apparatus, constitutes the most important addition of the year in the way of equipment. Varied use of the 60-inch equatorial proves it to be alike effective in visual, photographic, and spectroscopic work. It is especially penetrating in its capacity to reveal the characteristics of globular star clusters and spiral nebulæ.

In view of the repeated failures of the contractors of St. Gobain, France, to cast a perfect disk for the 100-inch "Hooker telescope," it was determined to try the imperfect disk furnished by these contractors, but not accepted, four years ago. Accordingly an agreement was entered into with the makers to try shaping the disk, and to pay therefor in case it proves sufficiently stable after adequate trial. This work was begun early in the year, and good progress has already been made, although some delay

must result by reason of the illness of Professor Ritchey and his chief assistant in this delicate and laborious task. In the meantime the glass-founders of St. Gobian are unremitting in their efforts to secure a perfect disk.

It is with deep regret that the observatory and the institution are called upon to record the unexpected death, on May 24, 1911, of Mr. John Daggett Hooker, to whom the enterprise of the 100-inch telescope owes its inception. His intelligent interest in and appreciation of the work of the Mount a gift of $50,000 in 1906 for the purchase of a disk and for the shaping of it for a 100-inch reflecting telescope. Unfortunately the difficulties in the way of casting so large a disk of glass, together with his untimely death, have prevented him from realizing his desire to see this telescope in use. But if the enterprise succeeds, as now seems quite hopefully probable, the observatory and the institution will be glad to link the constancy of his faith in scientific investigation to the constancy of the stars by means of diligent applications of the "Hooker telescope" to astronomical research.

DEPARTMENT OF TERRESTRIAL MAGNETISM

The magnetic survey of the globe undertaken by this department is proceeding effectively on both land and sea. Observations of the magnetic elements of declination, dip and intensity have been made at numerous points on the continents of Asia, Africa, Australia, Europe, South America and on the Polynesian Islands; while the non-magnetic ship *Carnegie* has secured a large quantity of data of immediate practical utility to navigation and of still greater importance, doubtless, in their relations to the general problem of terrestrial physics.

At the end of the previous fiscal year the *Carnegie* was en route from the mouth of the Amazon to Rio de Janeiro. After visiting the ports of Rio de Janeiro, Montevideo, Buenos Aires and Cape Town, she arrived at Colombo, Ceylon, June 7, 1911. Having started on her present circumnavigation cruise June 20, 1910, her arrival at Colombo marked the end, approximately, of the first year out. During this year she traversed upwards of 23,000 nautical miles, measuring magnetic declinations at 252 different points, and dip and intensity at 172 different points at sea. In addition to this work, corresponding complete determinations were made on land at seven ports and intercomparisons of magnetic instruments were made at three ports.

Unexpectedly large errors have been found almost everywhere, except in the south Atlantic Ocean, in the best compass sailing charts now in use. This is especially the case in the Indian Ocean, for which some recently issued charts are in error as much as 4° to 6° in the "compass variations" assigned. To meet the pressing needs of mariners for more trustworthy charts, the data obtained by the *Carnegie* are promptly furnished to the hydrographic establishments of the world engaged in the publication of magnetic charts. It appears from the investigations of the department that the chief source of the errors in existing charts lies in a lack of knowledge of the secular variation of the magnetic elements. It is worthy of note, also, in this connection that observations of atmospheric electricity and atmospheric refraction have been carried on during this voyage of the *Carnegie*. The importance of precise navigation in recent times gives special interest to the outstanding uncertainties due to atmospheric refraction.

Expeditions for land determinations of magnetic data have been made to many

countries and to many islands. The most extended of these are that carried out by Mr. Stewart in traversing the length of the Amazon River and that by Mr. Sligh in Asia Minor, Turkey, Arabia, Greece, Tripoli, Tunis and Algeria. The director of the department, on his way to meet the *Carnegie* at Colombo, made observations at Tau Island, of the Samoan Group, on the day of the total solar eclipse, April 28, 1911; and also at six other island stations in the course of his voyage.

The office work of computation and compilation of results and of the construction and testing of instruments has proceeded simultaneously with the operations on land and sea. A complete collection of the data obtained since the establishment of the department, including those of the cruises of the *Galilee* and *Carnegie,* will be ready for publication by the end of the present calendar year. Three portable magnetometers have been completed and four others are under construction, while various improvements to instruments and apparatus in use have been made, along with all current repairs, in the construction and repair shop of the department.

INVESTIGATIONS OF RESEARCH ASSOCIATES

Between fifty and sixty research associates have carried on investigations under the auspices of the institution during the year, either by aid of grants made directly to them or for the purpose of publishing results of their investigations. Several of these associates have been connected with the departments of investigation. Many collaborators have also participated in the researches carried on under this head, and the fields of investigation are numerous and of very diverse kinds. An idea of the extent and variety of this work can be best gained by consulting the reports, in the current Year Book, of the individual investigators, by reference to the annual list of publications of the institution and the general bibliography of the year. As indicating the diversity of these investigations, attention may be called to two remarkable publications in widely different fields. One of these is a treatise on dynamic meteorology and hydrography, by Professor V. Bjerknes, of the University of Christiania, and marks a noteworthy advance in this difficult branch of mathematical physics. Part I. of this work has been issued and Part II. is now in press. It is interesting to note, also, that permission has been given to a foreign publishing house to bring out an edition of this work in the German language. The other work referred to is entitled "The Polynesian Wanderings," by Mr. William Churchill. It attempts to trace the migrations of the Polynesians in the Pacific Ocean by means of a critical examination of the philological contents of their language. Mention may also be made in this connection of progress in the publication of the Classics of International Law, one work of which—namely, that of Richard Zouche—having been completed.

CHARLES X. DALTON

The passing of Charles X. Dalton removes a personality familiar not only to a large circle of scientists throughout the country but to many of Boston's leading business men, with whom he had a large acquaintance owing to his association with that eminent optician, the late Robert B. Tolles.

Born in Philadelphia in 1840, Mr. Dalton learned his trade as an expert mechanician from a German instrument-maker of that city. In his early days he worked in the factory of Joseph Zentmeyer, the well-known microscope manufacturer, and during the Civil War, served as an army nurse. At the close of the war, he entered the employ of Tolles, and later (1867) was associated with him in the Boston Optical Works.

This enterprise, while never profitable financially, owing its existence for many years to the liberality and public spirit of a few wealthy citizens of this city, was epoch making for the industry, nevertheless; for the microscopes and small telescopes produced in its dingy shop attracted the attention of the whole scientific world and set standards not only for America, but Europe as well. To Mr. Dalton was entrusted the making of all the metal work which embodied the intricate designs of the great optician.

The freely spoken encomiums of the best instrument-makers of Europe attesting to the superiority of workmanship of the Tolles objectives have more than once made special mention of the excellence of their metal work. This Boston company was all too short lived, owing to the untimely death of Tolles in 1883, but many of Tolles's instruments, treasured to-day by connoisseurs as still unequalled, remain as fitting memorials of the genius of this master optician, and will also keep alive the memory of the clever mechanician whose deft workmanship contributed so much to their excellence.

For one or two decades preceding and immediately following the Civil War there was a widespread popular interest in the microscope among cultivated people as a form of amusement, although much serious scientific work was done likewise. Microscope clubs were common throughout the land, and in England as well. Many became experts in microscope technique and there was an active demand among the wealthier of these enthusiasts for the best instruments that could be produced, irrespective of cost. This stimulated the instrument-makers of England and America to use the utmost skill and best workmanship, and in the hands of famous opticians, among whom Tolles with his giant genius shone preeminent, the microscope was carried to a high degree of elaboration and efficiency. It was under such conditions that Charles Dalton was inspired to use his skill and cunning as an artificer of metals. Dalton was not a workman for wages only. He had that true love of his craft and a pride in his workmanship which characterized the true craftsman and which is vital for best results. He would never do mediocre work and was his own severest critic of his product. He made many of his tools and appliances and accomplished much by primitive but cunning methods which are a lost art to the mechanician of to-day, or made possible only by the use of elaborate tools.

The death of Tolles practically ended the work of the Boston Optical Co. A few instruments designed by Tolles were completed by his workmen, but no successor could be found to give adequate expression to the original genius of the master. For many years Mr. Dalton has carried on the business in the old Hanover Street building, making repairs on the Tolles instruments which have been sent to him as the only one competent to make them and doing a general business in the sale and repairs of optical and other delicate instruments.

The wane in popular interest in the microscope as a recreation for the dilettante and the cheap compact "continental" instrument, of high optical efficiency but reduced to the simplest terms as to finish and accessories, in short a laboratory tool designed solely for the special work at hand has become common in our schools and colleges. Such instruments of good quality are now turned out by the thousands by the great manufacturers, using labor-saving machinery and modern systems of divided labor, and a good microscope is cheaper to-day than formerly. The elaborate instruments of Tolles and other great opticians of the past generation, instruments in which cost was subordinated to every detail which added to convenience and efficiency, masterpieces of ingenious and perfect workmanship, are no longer made, and with them is disappearing the old-time workman whose knowledge and craft partook almost of the dignity of a profession.

No doubt this condition is quite in accord with modern ideas and economics, but there may be some who view the changing times with some regret, some who have known the spirit and moral fiber of the old craftsman

and rejoiced in the fruits of his workmanship. May be there are some who still feel that there is a dignity and fitness in studying the beautiful in science for its own sake even by the untrained, and take the microscope as more than a laboratory tool.

The originality and workmanship of these old instrument-makers are still felt and long will be felt in the industry. European microscopes which till comparatively recently have been of the most primitive types, are gradually changing in design by adoption of many of the original optical and instrumental features of Tolles and his contemporaries, bearing witness to the permanence and soundness of their work.

Mr. Dalton in his later years made most of the repairs on the microscopes and chemical balances of the Harvard Medical School, Massachusetts Institute of Technology, Wellesley College, and in fact of most of the educational institutions in and about the city, his work in this line occasionally taking him as far as Vassar.

Through this business, he had a wide circle of acquaintances and will be missed by many who have looked with pleasure on the coming of the genial little gentleman who with his clear complexion and bright eye looked seventy years young, a man whose scrupulous cleanliness of person but exemplified his own blameless character, a normal man and the highest type of American craftsman.

Geo. W. Rolfe

THE SECOND INTERNATIONAL CONGRESS OF ENTOMOLOGY

The first International Congress of Entomology, held in Brussels on August 1–6, 1910, was an unqualified success. It was well supported by entomologists of all countries, both theoretical and practical, and also by many governments and institutions, which are at last beginning to realize the profound importance of this science in medicine and in agriculture. The membership was nearly 400, and upwards of 300 actually attended the proceedings. The results of the deliberations are being published in two volumes, the first being devoted to the proceedings and discussions, the second to the numerous memoirs contributed by many authorities upon a great variety of subjects, including papers devoted to pure and to economic entomology. The volume of memoirs (515 pages, 27 plates) is now published and issued to members. The volume of proceedings will follow shortly.

It was decided at the first congress that the second congress should be held in 1912, and the following meetings every three years from that date, so that in future the International Congress of Entomology will be held one year before the International Congress of Zoology. The second congress will therefore be held at Oxford on August 5 to 10, 1912, under the presidency of Professor E. B. Poulton, D.Sc., F.R.S. A reception committee has been formed, consisting of:

Dr. F. A. Dixey, F.R.S. (Chairman).

Professor G. C. Bourne, F.R.S. (Professor of Zoology).

Professor H. L. Bowman, D.Sc. (Secretary to the Delegates of the University Museum).

Professor E. B. Poulton, D.Sc., F.R.S. (President of the Second Congress).

Geoffrey W. Smith, M.A. (Fellow of New College).

Commander J. J. Walker, M.A. (Secretary of the Entomological Society of London).

H. Eltringham, M.A. (Cant.), M.A. (Oxon.), and G. H. Grosvenor, M.A. (Secretaries).

It is hoped that the reception committee will be able to arrange for members of the congress to have rooms in the colleges at a moderate price, but this privilege will be available for gentlemen only. In order to facilitate the arrangements, it is requested that ladies and gentlemen who propose to join and attend the Congress send in their names as early as possible to the general secretary of the executive committee, who will be happy to give any further information. Ordinary members who pay £1 (25 francs) will receive all publications of the congress. Ladies and children accompanying members will, on payment of 10s. (frs. 12.50) each, have all privileges of members except that of receiving the publications. Life members who pay a com-

position of at least £10 (frs. 250), will receive free all future publications of the congress. The funds received in respect of Life Compositions will be invested, and only the interest will be at the disposal of the executive committee. Sir Daniel Morris, D.Sc., and the Hon. N. Charles Rothschild, M.A., F.E.S., have kindly consented to act as trustees of the funds. Members who propose joining the congress, or presenting papers, are requested to address the general secretary of the executive committee, Malcolm Burr, D.Sc., care of Entomological Society of London, 11 Chandos Street, Cavendish Square, London, W.

ANTARCTIC EXPLORATIONS

As every one knows from the daily press the Norwegian explorer, Captain Roald Amundsen, who made the first northwest passage ever accomplished by ship, has added to his laurels by reaching the South Pole. He verifies Shackleton's report that the pole is on an ice-capped plateau more than ten thousand feet above the ocean. Amundsen also discovered ranges of mountains, the peninsularity of King Edward VII. Land, and the origin of the oceanic ice-cap, known as Ross's Barrier. As soon as information as to the extent of the scientific work is received it will receive proper notice from SCIENCE.

Of the highest importance to the standing of American antarctic explorers is the information that the Australian antarctic expedition, in the ship *Aurora,* has verified in a general manner the accuracy of the discoveries of Captain Charles Wilkes, U. S. Navy, in 1840, of the Antarctic Continent. The leader of this expedition was Dr. Douglas Mawson, well-known to the readers of SCIENCE through his location of the South Magnetic Pole, in 72° 24′ S., 155° 16′ E. (SCIENCE, May 10, 1910). Dr. Mawson landed, February 19, on the glaciers of Adelie Land, with a party that remains there during the Antarctic winter. Another party under Dr. White is pursuing its scientific work at Termination Land, where it landed January 18. It is hoped that this confirmation of the reliability of American work will be set clearly before the American people as soon as details are obtainable.

SCIENTIFIC NOTES AND NEWS

REAR ADMIRAL GEORGE WALLACE MELVILLE, U.S.N., retired, known for his Arctic explorations and eminent as a mechanical engineer, formerly engineer in chief of the U. S. Navy, died on March 18, aged seventy-one years.

DR. W. H. WILEY has resigned the position of chief of the Bureau of Chemistry of the Department of Agriculture, which he has held since 1883.

AMONG the degrees conferred, on the occasion of the exercises commemorating the one hundred and twenty-fifth anniversary of the University of Pittsburgh, were the following on men of science: The doctorate of laws on Edgar F. Smith, provost of the University of Pennsylvania; N. L. Britton, director of the New York Botanical Garden, and L. O. Howard, chief of the Bureau of Entomology and permanent secretary of the American Association for the Advancement of Science. The doctorate of science on Ira N. Hollis, professor of engineering at Harvard University; C. F. Scott, professor of electrical engineering at Yale University; H. D. Campbell, dean of Washington and Lee University; A. D. Mead, professor of comparative anatomy at Brown University; C. M. Snelling, dean of the University of Georgia; R. K. Duncan, director of the department of industrial research of the University of Pittsburgh; James Ewing, professor of pathology at the Cornell University Medical School, and Milton J. Greenman, director of the Wistar Institute of Anatomy.

THE Smithsonian Institution was represented at the centennial celebration of the founding of the Academy of Natural Sciences of Philadelphia this week by Dr. Charles D. Walcott, Dr. Richard Rathbun, Dr. Frederick W. True and Dr. Theodore Gill. Dr. Leonhard Stejneger represented the U. S. National Museum, and Mr. F. W. Hodge the Bureau of American Ethnology on this occasion.

A portrait of Dr. James Tyson, emeritus professor of medicine, painted by Mr. Hugh H. Breckenridge, has been presented to the University of Pennsylvania.

Dr. Wilhelm Wundt, professor of philosophy at Leipzig, has been made a knight of the Prussian order "pour le mérite."

Lieut.-Colonel D. Prain, F.R.S., director of the Royal Botanic Gardens at Kew, has been elected a foreign member of the Royal Swedish Academy of Sciences, to fill the vacancy left by the death of Sir Joseph Hooker.

Dr. R. Ruedemann, assistant state paleontologist of New York, has been elected a member of the Academy of Sciences at Halle.

M. Louis de Launay, professor of applied geology in the Paris School of Mines, has been elected a member of the Paris Academy of Sciences.

Dr. Krümmel, professor of geography at Marburg, has been elected an honorary member of the Geological Society of Frankfort.

Dr. Theo. B. Comstock has resigned as secretary and chief engineer of the Board of Public Utilities of Los Angeles.

At the end of the current year Professor Frank Fanning Jewett will retire under the Carnegie Foundation from the headship of the department of chemistry of Oberlin College after thirty-two years of active service. Professor Jewett received the A.B. from Yale in 1870, followed by the A.M. in 1873. He then studied at Göttingen and the University of Berlin. His first teaching appointment was that of assistant to Dr. Wolcott Gibbs at Harvard in 1876. The next four years were spent as professor of chemistry in the Imperial University of Tokyo, Japan. He was then called to head the department at Oberlin.

The eight men who have influenced Wisconsin agriculture most are in the order named: Professor W. A. Henry, Professor Stephen M. Babcock, ex-Governor W. D. Hoard, Hiram Smith, Professor R. A. Moore, Dean H. L. Russell, Professor F. H. King and George McKerrow, according to the articles submitted by students of agricultural journalism in the University of Wisconsin.

Mr. F. G. Figg, formerly first assistant at the Colonial Observatory, Hongkong, has been appointed director of the Mauritius Observatory.

Professor Aug. Cramer, of Göttingen, has been appointed the successor of Professor Ziehen, as director of the psychiatric clinic of the University of Berlin.

Dr. Fingerling, of the Agricultural School at Hohenheim, has been elected director of the Agricultural Experiment Station at Möckern.

Mr. Selskar M. Gunn, assistant professor in the department of biology and public health of the Massachusetts Institute of Technology, has become the editor of the *Journal* of the American Public Health Association, succeeding Dr. Burt R. Rickards.

Dr. Walter S. Tower, of the University of Chicago, sailed from New York, on March 20, for South America, where he intends to spend six months studying the economic geography of Argentina, Chile and southern Brazil.

At the summer session of the Venice Marine Biological Station of the University of Southern California from June 24 to August 2, Professor Charles L. Edwards will give a course of lectures upon marine biology and direct the work in the laboratory and upon the motor sloop *Anton Dohrn*.

Dr. Wilder D. Bancroft, professor of physical chemistry at Cornell University, lectured before the Columbia University Biochemical Association on March 15. His subject was "The Study of Environment."

At the annual meeting of the Columbia Chapter of Sigma Xi, Professor Wm. J. Gies, gave an address on the chemistry of digestion.

Professor W. K. Hatt, of Purdue University, delivered an exchange lecture before the students and faculty of the College of Engineering of the University of Illinois, March 6, on "Timber Preservation." He also gave an address before the freshmen of the College on "Mountain Railways."

BEFORE the Chemical Society, London, on February 29, Sir William Ramsay delivered a memorial lecture in honor of Henri Moissan, the eminent French chemist who died five years ago.

THE death is announced of Dr. Dittmar Finkler, professor of hygiene at Bonn; of Dr. Richard von Stoffela, professor of medicine at Vienna; of Professor Richard Andree, the geographer of Brunswick, and of Dr. A. Grünhegen, professor of medical physics at Königsberg.

MR. JAMES J. HILL has announced that he will build and maintain in St. Paul a reference library to cost not less than $350,000.

THE *Medical Record* states that at the fourth annual meeting of the national committee for mental hygiene, held in New York, on February 17, a campaign was inaugurated which has as its object the improvement of conditions affecting the mentally afflicted. An anonymous gift of $50,000 enables the committee to start the work without delay. Dr. William L. Russell, superintendent of Bloomingdale Hospital, was appointed chairman of a subcommittee which will survey the national field, under the personal leadership of Dr. Thomas W. Salmon, of the United States Public Health and Marine Hospital Service, who has been granted leave of absence for this purpose. Dr. Llewellys F. Barker, of Johns Hopkins University, was elected president of the committee.

AT a meeting held on Tuesday evening, February 20, the Minnesota Pathological Society was formed, with nearly fifty charter members present. The following officers were elected:

President, Dr. A. S. Hamilton.
Vice-president, Dr. J. S. Gilfillan.
Secretary, Dr. H. E. Robertson.
Treasurer, Dr. J. F. Corbett.
Censors, Drs. F. L. Adair, R. H. Mullin and H. A. Tomlinson.

THE American Scenic and Historic Preservation Society takes pleasure in announcing that it has been accorded by the United States Department of the Interior the honor of exhibiting for the first time a collection of pictures of National Parks, made by the Interior Department for the purpose of illustrating the work of the federal government in the protection of regions of great landscape beauty and natural phenomena. By the courtesy of the National Arts Club of New York, the pictures will be hung in its galleries at No. 15 Gramercy Park, and will be on exhibition under the auspices of this society from Wednesday, March 13, until and including Saturday, March 30. During this period the public will be admitted without cards on week days, from 10 A.M until 6 P.M. After this exhibition the pictures will be sent on a tour for similar display in different parts of the United States.

THE statement appearing in the issue of SCIENCE of February 2, on page 197, regarding the passage of a resolution by the American Economic Association in favor of an International Commission on the Cost of Living, was inaccurate. At a round table discussion led by Professor Fisher the persons present voted unanimously in favor of such a commission, but owing to a provision in its constitution providing that the Economic Association will not commit its members to any position on practical economic questions, no formal resolution was passed.

THERE will be a U. S. Civil Service examination on March 30, for the position of dairy chemist, in the Bureau of Animal Industry, at a salary of $1,800.

AN astronomical bulletin from the Harvard College Observatory states that seven excellent photographs of the spectrum of Nova Geminorum No. 2 were taken at Harvard on March 13 and the same number on March 14. A marked change occurred in the spectrum, the photographs on the first date showing only dark lines while the hydrogen lines $H\beta$, $H\gamma$, $H\delta$ and $H\epsilon$ have well marked bright lines on the edge of greater wave length, on the second date. Those last photographs closely resemble those of Nova Persei No. 2, on Feb-

ruary 24, 1901. The bright lines seen with the slit spectroscope at Ann Arbor may have been too narrow on March 13, to show with an objective prism. The brightness of the star has increased, and was about 3.5 magn. on March 14.

Doflein's excellent "Lehrbuch der Protozoenkunde," the most complete of modern works of its kind, met with such immediate success that scarcely a year had elapsed before he began a third edition. The preface of this edition is dated September 3, and the book, published by Fischer, has been on the market for two or three months. So rapid has been the advance of protozoology, that not a chapter has escaped revision, or rearrangement with additions, the net result being an increase in number of pages from 914 to 1,043. In addition to the many new species introduced there is a new chapter on species, variation and inheritance. The author's attitude on special problems has not been changed and the parasitic forms, as before, receive the bulk of attention.

A meeting of the members of the Central Branch of the American Society of Zoologists will be held at the University of Illinois, Urbana, Illinois, in the new Natural History Building, on April 4, 5 and 6. Thirty-five members have expressed their intention to be present at this meeting, but it is expected that a large number will be able to attend. The meeting will begin with a smoker at the University Club, on April 4, when President Edmund James will address the society. The formal program will begin on Friday morning at 9:30, with an afternoon program at 2. Professor George Lefevre will deliver the presidential address at the banquet at the University Club on Friday evening. The Saturday morning program will begin at 9:30. There will also be an afternoon program, if it seems necessary. Members of the society who expect to present papers should send titles to the secretary, Professor H. V. Neal, Knox College, Galesburg, Ills., not later than March 21. The printed programs will be sent out about the twenty-fifth inst.

The Tennessee Academy of Science was organized at a meeting held in Nashville recently. A constitution was adopted and steps taken to hold an initial meeting in April. At this meeting in addition to a regular program the officers of the academy will be elected and steps taken to extend the membership so as to include all white persons in the state who are interested in any phase of science or cognate subjects. Meetings are to be held annually on the Friday following Thanksgiving. For the present the movement centers in the office of the state geologist at Nashville.

The Cooper Ornithological Club, an organization of western bird students, has recently established two permanent committees for the conservation of wild life. The chief objects of the club in doing this may be stated as follows: (1) To cooperate with other organizations, including the State Fish and Game Commissions and the Federal Bureau of Biological Survey, to the end that the wild life yet remaining in state and nation may be more effectively protected. (2) To work at all times for an enlightened public sentiment along lines of the conservation of wild animals. Following is the personnel of the committees. For the northern division of the club, W. P. Taylor, Museum of Vertebrate Zoology, Berkeley, *chairman;* H. C. Bryant, University of California; J. S. Hunter, State Fish and Game Commission, San Francisco; H. W. Carriger, San Francisco, and John W. Mailliard, San Francisco. For the southern division, Frank S. Daggett, director Museum of Science, Arts and History, Los Angeles, *chairman;* J. Eugene Law, Hollywood; H. J. Lelande, Los Angeles; Howard Robertson, Los Angeles, and G. Willett, Los Angeles.

A series of seven lectures on "Public Health" subjects are in progress at the University of Illinois. These lectures, given on Wednesdays and Fridays, beginning March 13, are as follows: "Sociological Aspects of Public Health," by Dr. Henry B. Favill, of Rush Medical College, Chicago; "Influence of Water Supplies on Public Health," by Professor Edward Bartow, University of Illinois;

"How Not to Be Sick," by Dr. John N. Hurty, secretary of the Indiana Board of Health. "Bovine Tuberculosis and Its Relation to Public Health," by Dr. Mazyck Porcher Ravennel, professor of bacteriology at the University of Wisconsin; "The Influence of Disease on Civilization," by Dr. Victor C. Vaughan, dean of the department of medicine, University of Michigan; "Ventilation of Schoolrooms and Bedrooms," by Dr. William A. Evans, of the Chicago *Tribune;* "Milk," also by Dr. William A. Evans.

ABOUT forty students of the University of Illinois, pursuing courses in Railway Engineering or Railway Administration, have joined in forming the Railway Club of the University of Illinois. The object of the club is to provide for informal meetings for a discussion of railway problems and to promote good fellowship among its members. The officers for the present semester are: H. E. Marquette, president; A. C. Van Zandt, vice-president; W. C. Sadler, secretary; A. S. Nevins, treasurer; E. L. Tinzmann, sergeant-at-arms.

A NEW map of the state of Illinois on a scale of approximately eight miles to the inch is ready for distribution by the State Geological Survey. It is prepared in three colors so as to represent drainage features in blue; railroads, land lines, towns, etc., in black, and county boundaries and figures showing altitudes above sea level for various towns in red. This map eliminates the errors of early land surveys, so that places are now shown with correct latitude and longitude. Railroad alignments are all highly accurate.

UNIVERSITY AND EDUCATIONAL NEWS

THE Massachusetts Institute of Technology has received from a donor whose name for the present is anonymous, a gift of two and a half million dollars for the erection of the buildings on its new site.

ACCORDING to the Boston *Transcript,* Harvard University has received subscriptions amounting to $1,200,000 for the erection of freshmen dormitories.

MT. HOLYOKE College has received an anonymous gift of $50,000 for the endowment fund which now amounts to about $370,000.

THE University of Toronto has received from Mrs. William Freeland the gift of an endowment for a fellowship in anatomy in memory of her father, the late Dr. James H. Richardson, who for many years was professor of anatomy in the Toronto School of Medicine and the University of Toronto. The fellowship is to be known as the James H. Richardson research fellowship in anatomy, and is of the value of $500. It is open to graduates of recognized universities and medical colleges, and to students of the University of Toronto who have completed the third year of the medical course in that institution. The holder of the fellowship will be required to devote his entire time during the tenure of the fellowship to investigation in anatomy under the direction of the professor of anatomy in the University of Toronto.

THE New York School of Applied Design for Women has received a bequest of ten thousand dollars by the will of Miss Cora F. Barnes. Also a Scholarship in Perpetuity, of one thousand dollars from Miss Catherine A. Bliss.

IT should have been stated in SCIENCE last week that Dr. Horace David Arnold had been appointed dean of the Graduate School of Medicine of Harvard University, not of the Harvard Medical School. The graduate school of medicine is a new department of the university, being a part of the faculty of medicine. It should also have been stated that Dr. Edward Hickling Bradford would retire from the chair of orthopedic surgery and become professor emeritus.

THE Bryn Mawr European fellowship awarded to the student receiving the highest grade has been given this year to Miss Nora Cam, who has specialized in mathematics and physics. The president's European fellowship has been awarded to Miss Bernette Lois Gibbons, a student of chemistry.

CHAS. H. TAYLOR, professor of mineralogy at the University of Oklahoma, has been pro-

moted to the head of the department of geology. At the same meeting Mr. Irving Perrine, instructor in geology at Cornell University, was appointed associate professor of geology.

Dr. Percy E. Raymond, formerly of the Carnegie Museum, Pittsburgh, and more recently paleontologist to the Geological Survey of Canada, has been appointed assistant professor of paleontology at Harvard University, and curator of invertebrate paleontology in the Museum of Comparative Zoology.

DISCUSSION AND CORRESPONDENCE

NUMBER OF STUDENTS PER TEACHER

To the Editor of Science: In the January 26 number of Science is a note on the "Number of Students per Teacher," by Professor A. S. Hathaway, in which he says:

> It appears to me that the only correct way to determine the average number of students handled per teacher in any school is to divide the number of student hours per week by the number of teacher hours per week.

This formula might simplify the *mere* mathematics of the situation, but it would most certainly fail to give just the information desired—the strength of the teaching force in an institution, or, in the words of Professor Hathaway, "the average number of students handled per teacher." It is then far from being *a* correct way, to say nothing of *the only* correct way.

The following illustration will show how the method suggested would miss the very purpose of our calculations. Suppose that a college of 300 students, averaging 15 hours recitation per week each, has 5 instructors, each teaching 20 hours per week; then the result would be, according to the formula suggested,

$$300 \times 15 \div 5 \times 20 = 45 \text{ ''students handled per teacher.''}$$

Now, another college with the same number of students, each reciting also on the average 15 hours per week, but with 10 teachers, each meeting classes 10 hours per week, would show the same result; or a college of 225 students, averaging 20 recitations per week, with 10 teachers, each having 10 classes per week, would show 45 "students handled per teacher." Certainly the teaching forces of these schools would not be equally strong.

It is not particularly the average number of students per class, or recitation, that we are after. Even if this were our object we should find the matter more complicated than Professor Hathaway has supposed. Some "courses" require a proportionately larger number of recitations per hour's credit than others. And how should we treat laboratory work, which can not with fairness be classed with recitations? Some laboratory courses require very little outside work, but more work in the laboratory, while others require a considerable amount. What complicates the matter still more, is the fact that in many cases student assistants direct such courses in large part while in others professors attend to the work themselves. These are only a few of the complications one actually finds.

The class work does not afford the only opportunity for the teacher to assist and stimulate the student; and any scheme based upon class work alone would not only do an injustice to some of the very best of our educational institutions, but would also tend to emphasize unduly a practise that is doubtless already carried too far.

Joseph Peterson

University of Utah,
Salt Lake City

ARE TEACHERS ENTITLED TO COMPLIMENTARY DESK COPIES OF TECHNICAL BOOKS?

Here is the teacher's point of view:

The texts which I am using are of no personal benefit to me. I am supposed to use the latest edition, and to change the text once in a while. I do not see how I can well afford to buy them. The publishers get big profits out of the students and can well afford to give a copy to the teacher, while, on the other hand, the teachers' salaries are meager. And as to new reference books and practical engineering books, I can not always order them

for the college library without first seeing the book. So the only way left me is to ask publishers for a desk copy, however humiliating this may be.

Here is the publishers' point of view:

We consider it a good business policy to send a desk copy to the professor in charge of a course where a considerable number of our books are used. We also send copies of new books to professors prominent in their respective fields, hoping for returns on account of their recommendation. But the privilege of free books is greatly abused by some teachers, who finally succeed in accumulating fair-sized libraries of free books. Again, frequently we get requests for desk copies not only from the professor in charge, but also from all the instructors who assist him in his classes. Moreover, these requests come from the same schools year after year, showing that the instructors are allowed to appropriate the books. This we consider an unnecessary and unjust burden upon the retail price of technical books. At the same time we hesitate to refuse such requests, for obvious reasons. One of the worst features of the situation is that requests for desk copies come from colleges from which only two or three copies are ordered later on.

Here is the writer's point of view:

The question raised is one of equity and justice to both the teachers and the publishers. Moreover, the dignity of colleges of engineering is to be considered. Since this is a matter of ethics, equally applicable to practically all engineering colleges, it ought to be decided by the Society for the Promotion of Engineering Education. Other national engineering societies have committees on professional ethics, and this is evidently a problem for such a committee. A resolution approved by the society will have a great moral effect with both teachers and publishers, and would be an important step towards the solution of this vexed problem.

I feel rather strongly that all requests for free copies of books should be pronounced unprofessional and undignified. If a teacher does not care or can not afford to buy a book, the college ought to buy a copy and place it at his disposal as long as he needs it in his teaching, the book remaining the college property. The college provides the teacher with an office and its furniture, heat, light, stationery, lantern slides, lecture apparatus, etc. To provide text-books when requested would be but a small additional expense, but it would mean a great deal for the teachers, and would put the whole matter upon a dignified business-like basis. As it is now, the situation reminds one of the railroad passes, now fortunately prohibited by law.

As to new engineering books, it is to the advantage of colleges, publishers and teachers that an opportunity should be given to those engaged in teaching to see and to inspect all noteworthy new books relating to their respective subjects. This end can be attained easily without sending out complimentary copies. The publishers of engineering books could arrange to move a few copies of new books along definite "circuits," each comprising several colleges. In each college it would be the duty of the dean or of the head of the respective department to bring the new book to the attention of the faculty and to consider the advisability of ordering a copy for the college library. There is nothing compulsory in this scheme; it would be a privilege offered by the publishers, and if certain teachers should not care to avail themselves of this advantage that would be their own business.

As stated before, in my opinion it would be to the best advantage of all concerned if a distribution of complimentary books were done away with altogether, except perhaps as voluntary and unsolicited gifts from authors and publishers to their friends. However, with the above scheme of "circuit books" even these gifts would become less and less necessary, because in most cases a person merely wishes to know that a certain book has been issued and also likes to know its scope and plan. After that, it mostly becomes a dead weight in his library.

Should the suggestions made above be deemed too radical in view of the established custom and the conditions of the trade, I

would suggest for the consideration of the Society for the Promotion of Engineering Education the following partial improvement in the method of requests for desk copies:

1. All requests for desk copies to be sent to the publishers only by the deans of colleges, and not directly by individual teachers or heads of departments. This would insure more justice, uniformity and dignity.

2. All free copies to remain the permanent property of the college, and not of individual teachers. This will reduce the number of requests to a reasonable amount.

3. Whenever possible, teachers and colleges ought to purchase books and avoid asking for complimentary copies.

V. Karapetoff

Cornell University

SCIENTIFIC BOOKS

Melanesians and Polynesians; Their Life Histories Described and Compared. By George Brown, D.D. London, MacMillan & Co. 1910. Pp. 451, 70 illustrations. Price, $3.00.

The work is a comparative study of two groups of mankind generally supposed to have next to nothing in common. The relationship of these groups, however, has been maintained by some students since the epoch-making explorations of Wallace, who considered the Pacific peoples as variants of one race. Mr. Brown's theory, based principally on the languages concerned, in which he is an authority, is that a Negrito substratum formerly occupied the East Indies as far west as Borneo, also the continental skirts, and this stock became diluted by infusion of blood from India. Later the pressure of Malay tribes drove them out into the Pacific, the Polynesians having the greatest admixture of a light brown stock drifting to some point of radiation, perhaps Manua of the Samoan group, and the Melanesians, retaining more of the blood of the original black inhabitants, dispersed to the islands where they live at present. The Melanesians are thus regarded as the older, less commingled stock.

His long residence in New Britain and Samoa and his command of the native languages fit Mr. Brown especially for the work and his opinions are entitled to great respect. The intention to establish by comparison the cultural affiliation of the dusky and fair-brown peoples has produced a most interesting and valuable body of observations charmingly presented in clear English, not only a contribution to science in the way of an almost unique comparative study, but a non-controversial book well worth reading for general information.

Walter Hough

Herpetology of Missouri. By Julius Hurter, Sr., Curator, Academy of Science of St. Louis, Mo. Pp. 215; 12 pl. relating to structural characteristics.

There have been various *resumés* of the fauna of states, these publications of more or less economic value, but it is genuinely pleasing to note the appearance of the present work in which it is evident throughout that the author has devoted much labor and time in presenting a detailed and practical review. A publication like this stands as a fine example of what should be forthcoming from other workers on local fauna. Carefully systematized it also treats those economic features which greatly enlarge the field of usefulness. Too many of our local scientific workers devote a great amount of time and space to the treatment of synonyms, forgetting that this phase of their subject is of absolutely no interest to the great mass of readers, eagerly awaiting the zoological history of their home territory.

The farmer, the natural science teacher and the younger student will find Mr. Hurter's work of immediate and practical interest, while the technical descriptions are sufficiently elaborate to properly identify any of the species. There is a series of well-prepared plates relating to the mouth characters of salamanders and frogs, the foot characters of the latter, the scalation of serpents and like characters.

Looking through the systematic arrangement, one notes several apparently recent

changes in the nomenclature relating to families and genera. The author of the publication remarks that he has adhered strictly to the "International Rules of Zoological Nomenclature," adopted by the International Congress of Zoology. It seems a pity these adopted rules have been followed by the frequent discoveries that names familiar for the past quarter of a century and more, can no longer be permitted to stand. These never-ending changes and the constant growth of the list of synonyms bring about perplexing conditions, even to the technical worker. Some remedy might result, by accepting as a standard, a monumental world's work like Boulenger's "Catalogue of Reptiles of the British Museum." Time would, of course, elicit modifications, but with a standard agreed upon our technical workers would find more time for investigations along more original and generally valuable lines.

RAYMOND L. DITMARS
NEW YORK ZOOLOGICAL PARK

A REMARKABLE JOURNEY ACROSS THE SAHARA

ONE of the most daring journeys conceivable on the Sahara has recently been successfully accomplished by Count Réné le More who, almost alone, went from southern Algeria directly across the desert to Timbuctu. The journey of about 8,000 kilometers altogether, to Timbuctu and return, occupied about 13 months, of which three were passed in Timbuctu.

Leaving Ghardaia in November, 1910, le More reached Timbuctu in the last of April. He returned by nearly the same route. Discarding all precedents in Saharan travel, le More was accompanied by only two persons, a servant and an interpreter-guide, both of whom were Arabs. He had one Touareg riding camel and two small Algerian baggage camels, and carried the minimum amount of baggage, of which two or three American guns formed a prominent and a useful part.

No account of this journey has yet appeared, but in *Le Matin,* January 15, 1912, there is an interview giving some of the main facts. The route taken in going was by Ghardaia, el Golea, In Salah, Tamanrauet, Kidal to Gan Gao, on the Niger River, thence by the river to Timbuctu. On the return a slightly different course was taken, passing somewhat to the west of Timanrauet, but retracing the previous way from In Salah.

The entire journey was perilous, not only because of the natural dangers attending desert travel, but especially on account of hostile tribes. Soon after le More left Ghardaïa, I was told by an officer that the venturesome Frenchman would hardly be able to pass through the Touareg country with so small a company, the Touaregs would surely cut off his head. On the way le More went 29 days, going south from Timanrauet, without seeing any person outside of his own caravan. On the return the little company had exciting adventures in fighting off bands of robbers, coming off with better luck than other travelers through the region. Graves of several unfortunates were seen between Kidal and Gan Gao.

The purpose of the intrepid traveler was to study the country that he might later cross to Timbuctu by aeroplane. As a result he knows the best, or the only situation for relay stations, and much of the conditions attending desert travel, and he considers the project as possible of accomplishment. The result is that le More proposes to cross the desert again, but the next time in the air. Whether this difficult task is finally accomplished by le More remains to be seen, but there is little doubt that in the very near future aeroplanes will not be unknown in the extreme southern part of Algeria, since it is said that the French army in the colony has been actively engaged for several months in working out the details of an aeroplane corps with headquarters at Biskra.

Owing in large part to its relatively high elevation above the sea, the western Sahara is not so intensely arid as the eastern Sahara. In the vicinity of Ouargla and Ghardaia, for example, there is considerable vegetation, especially along the oueds. Le More's photo-

graphs show, also, that much further south, at In Salah and beyond, over half way to Timbuctu, there is a similar condition of affairs. It is probable, however, that the vegetation of the mesa-like areas, the *reg* or the *hamada*, may be barren in the extreme south, since even at Ghardaia there is very little vegetation on such areas. The mid-Saharan country is of the greatest interest botanically since there the Mediterranean element is almost wholly lacking, and the influence of the countries to the south of the desert begins to be felt. We shall await with much expectancy the promised detailed account of this remarkable journey.

W. A. Cannon

Desert Laboratory

BOTANICAL NOTES

SUPPLEMENT TO ENGLER AND PRANTL'S ALGAE

The volume of the "Pflanzenfamilien" containing the Algae (I., abt. 2) was completed fourteen years ago (1897), while most of the parts of which it was composed appeared several years earlier. In 1909 two supplementary Lieferungen were issued by Wille, in 1910 two more were issued by Wille, Kjellman and Svedelius, while two more were issued in 1911 by Svedelius. These have now been brought together by the Leipzig publisher, Wilhelm Engelmann, under the subtitle of "Nachtraege zum I Teil, 2, Abteilung." It covers the period from 1890 to 1910, and so brings the treatment of the Algae down to date.

The first thing one notices is the considerable modification of the schematic chart of the relationship of the families of the green algae. The five groups (classes) are developed from the Flagellata, the Protococcales being the primitive class with *Volvocaceae* as the lowest family. From the latter came the Conjugatae as a side line ending blindly. Above *Volvocaceae* are placed *Tetrasporaceae* which lead by one line through *Protococcaceae* to *Hydrogastraceae* and *Valoniaceae*, and by the other to *Ulvaceae*. The family *Valoniaceae* is regarded as the lowest of the class Siphonocladales, which culminates in *Dasycladaceae* and *Sphaeropleaceae*. From *Valoniaceae* a line reaches *Bryopsidaceae* in Siphonales, culminating in *Vaucheriaceae*. The *Ulvaceae* are the lowest of the Chaetophorales, which pass by several lines to *Chroolepidiaceae*, *Coleochaetaceae* and *Oedogoniaceae* at the summits of as many genetic lines. A significant thing in the treatment of these families of green algae is the association of five families of colorless plants as "Nebenformen" related to *Volvocaceae*, *Pleurococcaceae*, *Protococcaceae*, *Oocystaceae*, and *Oedogoniaceae*, thus adding another step to the movement for the obliteration of the distinction between algae and fungi, and their assembling into new groups on morphological characters.

In passing it may be noted that *Pleurococcaceae* are separated from *Protococcaceae* by the absence of zoospores in the former and their presence in the latter, contrary to some recent algologists. Nor has the author been stampeded into dividing *Hydrogastraceae* and in his system *Protosiphon* and *Botrydium* lie peacefully side by side as related genera in the same family. *Characeae* are still so placed as to immediately follow Siphonales, and by this one is reminded of Wille's suggestion of their relationship in his earlier treatment. The revision of the Phaeophyceae was partly made by Kjellman, and on his death it was continued by Svedelius. It thus happens that some of the families are the joint work of the two authors, while in other cases Svedelius alone did all of the work, as in *Sphacelariaceae*, *Laminariaceae* and *Fucaceae*. The revision of the Rhodophyceae also is the work of Svedelius. Here the treatment is necessarily the same as that of Schmitz and Hauptfleisch fourteen to fifteen years earlier. However in the difficult family of the *Corallinaceae* the genera of the earlier treatment are freely broken up into smaller ones in accordance with the trend of recent opinion, resulting in the recognition of twenty-four genera instead of nine, with a considerable shifting of their places in the family.

NOTES

WITHIN the past two years Dr. W. C. Coker has rendered a distinct service to botany by the publication of two historical papers in the *Journal of the Elisha Mitchell Scientific Society,* the first (April, 1910) entitled "A Visit to the Grave of Thomas Walter" and the second (July, 1911) "The Garden of Andre Michaux." Walter's grave is now in the midst of a dense forest growth in southern South Carolina, not far from the swamps of the Santee River, although when he was buried his grave was made in what had been his botanical garden. The flat stone over the grave tells us that he died "in the beginning of the year 1788." No traces of the garden remain. An old oak at the head of the stone is now heavily draped with *Tillandsia.* Here he lies alone in the dense wild shade of his forest-covered garden.

Michaux's garden was about ten miles from Charleston, but like that of Walters has become overgrown with a heavy forest growth of mostly native species, but undoubtedly some of the trees date from Michaux's time, and were probably planted by him.

THE same writer's report on "Science Teaching in North Carolina" (*N. C. High School Bull.,* July, 1911) contains some good suggestions in spite of the statement that the committee "has been unable to arrive at any general agreement" as to what the science work should be. However they agreed in one most important conclusion, namely, that where single courses in science are offered they "should include the most important facts and principles" of the sciences concerned, and this is commended especially for "students whose instruction is concluded with the high school."

IN the paper on "The Wilting Coefficient for Different Plants and its Indirect Determination" (U. S. Dept. Agric. Bureau of Plant Industry, Bull. 230) L. J. Briggs and H. L. Shantz attempt "to determine the extent of the variation exhibited by different plants with respect to the minimum point to which they can reduce the moisture content of the soil before permanent wilting occurs," with the result that they conclude that the differences "are so small as to be of little practical utility from the standpoint of drought resistance." There is, however, a "great range in the wilting coefficient due to soil texture." The bulletin can not easily be summarized, and must be read by every botanist who is interested in physiological problems. The apparatus used is very ingeniously devised.

ALLIED to the foregoing is E. N. Transeau's paper on "Apparatus for the Study of Comparative Transpiration" in the July, 1911, number of the *Botanical Gazette,* in which he describes new forms of chronograph, weight droppers and irrigators, which he has devised and found useful.

Two recent ecological papers by R. M. Harper may be listed here, namely, "The River-bank Vegetation of the Lower Appalachicola, and a New Principle Illustrated Thereby" (*Torreya,* No. 11, 1911) and "The Relation of Climax Vegetation to Islands and Peninsulas" (*Bull. Torrey Bot. Club,* Dec., 1911).

AMONG recent economic papers are "The Propagation of Guayule by Seed," by Dr. J. E. Kirkwood (*Am. Review of Tropical Agriculture,* Vol. I.); "The Artificial Ripening of Persimmons," by Professor F. E. Lloyd (Proc. Ala. State Hort. Society, 1911); "American Medicinal Leaves and Herbs," by Alice Henkel (U. S. Dept. Agric. Bureau of Plant Industry, Bull. 219). The last named should interest the students in our schools of pharmacy.

THE "Annual Report of the Director of Forestry of the Philippine Islands" for the year ending June 30, 1911, contains much interesting matter for the botanist and general reader as well as for the professional forester. It is evident that there are serious forestry problems on the Islands not wholly unlike those that confront us in the United States, for the reckless destroyer is there just as he is here.

"The Forests of Oregon" (Bull. I., Oregon State Board of Forestry, 1911), by Professor G. W. Peavy, and the "First Annual Report of the State Forester" of Oregon (1912), by F. A. Elliott, indicate the state of mind of the people of the northwest in regard to the conservation of their forests.

One of the best of recent publications on trees is "New England Trees in Winter," by Professors Blakeslee and Jarvis, of the Storrs Agricultural Experiment Station (Bull. 69, 1911). After a helpful introduction, by means of keys the student is led to the principal genera, where further keys lead him to the species, and last to full descriptions accompanied by excellently selected photographs (in "half tone"). We do not recall any better treatment of our trees than is to be found in this publication, nor anything approaching it in other station bulletins. The authors are to be congratulated upon the quality of the matter which they have presented, and the Station upon its wisdom in giving it publication.

Here may well be mentioned favorably E. R. Jackson's "Forestry in Nature Study" (U. S. Dept. Agric. Farmers' Bulletin, 468), which should be found in every public school in the country. Mr. Lamb's "Key to Common Kinds of Trees" (p. 38) should prove helpful to many teachers who have somewhat hazy ideas as to the identity of the trees about them.

Charles E. Bessey
The University of Nebraska

SPECIAL ARTICLES

THE ACCUMULATION OF OIL AND GAS IN SANDSTONE

Let two plates of glass be slightly inclined to each other and touching along one edge. Place by means of a pipette some petroleum and water between the plates. By manipulation of the plates, cause a bubble of air and oil to be enclosed within the water. It will be noticed that while the oil surrounds the air, much more than half of the oil will lie toward the thinner end of the combined bubble. This would, of course, naturally follow, since liquids are subject to capillarity and gases not.

Let us now consider the newly formed strata of marine or lagoon shales and sandstones, which are potentially petroliferous. All the interstices will at first be filled with water. Assuming now that the petroleum and natural gas arise from chemical changes in included organic substances, principally in the shale, we have the following sequence of events. The gas that originates finds itself forced by the greater hold that the water has for the fine interstices to take a position in the largest near interstice. If this is more globular than tubular or flat, a bubble of gas will be thus imprisoned, otherwise it will move along till it reaches the largest lacuna. In other words, much of the gas will leave finer grained rocks for the coarser, and so produce an accumulation of gas in sandstone reservoirs. Gas then is the first constituent to be forced into these reservoirs.

But further, although petroleum has a lower capillarity constant, it has an extraordinary capacity of spreading along a surface between water and a gas. This is shown by the way oil will surround a bubble of air in water between two plates of glass. Therefore, in the movement of the gas bubble from the place of origin to the reservoir, each will carry with it a pellicle of oil, and thus accomplish an accompanying movement of oil from the place of origin to the reservoir.

I regret that I have not the facilities to demonstrate experimentally these principles, since they would be easily put to the test, given the required apparatus.

As to their practical bearings,

(*a*) Since the shale can contribute to a neighboring sandstone reservoir, contiguous bodies of organic shale and limestones would be considered favorable circumstances, rather than negligible as held by I. C. White, who finds the origin of the oil and gas within the sandstone.

(*b*) A reservoir may be expected to receive its oil and gas from shale above as well as below.

(*c*) A sandstone embedded within shales that seem to have very little oil in them may

yet have derived its oil from them in the past. The oil has been largely moved away as formed. Hence, richly petroliferous shales are not a necessary indication in oil prospecting.

(*d*) Gravitational sorting requires not only a certain necessary degree of dip, but also a necessary degree of porosity, because in interstices below a certain size, surface tension checks the motion necessary for gravitational sorting. For this reason, water-filled shales or very fine-grained sandstones or limestones lying above porous rocks, act as impervious barriers, instead of allowing the oil and gas to reach the surface.

(*e*) While gas can move in a water-saturated rock with a lower degree of dip or with a lower porosity than oil, yet, since the gas bubble carries with it a pellicle of oil, a certain quantity of oil can be carried where it would not otherwise move.

(*f*) Inasmuch as all porous reservoirs in the strata constituting our oil fields were originally water-filled, dry porous sands really contain gas. It is not recognized because not under sufficient pressure to escape noticeably. This gas has been contributed to it generally by neighboring strata, and may have served for the transport of oil. As gas becomes more expensive, this gas may be extracted by suction, as is already done in gas-sands which have lost their pressure.

Of course, the principles here proposed are not exclusive of the action of gravitation and moving water, but act in conjunction therewith.

ROSWELL H. JOHNSON
BARTLESVILLE, OKLAHOMA

THE AMERICAN SOCIETY OF ZOOLOGISTS

THE Eastern and Central Branches of the American Society of Zoologists met in joint session at Princeton University, Princeton, N. J., December 27 and 29, 1911, in conjunction with the American Society of Naturalists and the American Association of Anatomists.

The following officers of the Eastern Branch for the ensuing year were elected:

President—A. G. Mayer, Carnegie Institution of Washington, D. C.

Vice-president—G. A. Drew, Marine Biological Laboratory, Woods Hole, Mass.

Secretary-treasurer—John H. Gerould, Dartmouth College, Hanover, N. H.

Additional Member of the Executive Committee—H. E. Jordan, University of Virginia.

These officers, in addition to David H. Tennent and Ross G. Harrison, will constitute the executive committee of the Eastern Branch. It is understood that the same officers of the Central Branch that served last year will continue in office.

The following persons were elected members of the American Society of Zoologists:

Central Branch—J. Frank Daniel, University of California; T. W. Galloway, James Milliken University; Wilhelmine Enteman Key, Lombard College; George R. La Rue, University of Michigan; Joseph A. Long, University of California; Marian L. Shorey, Milwaukee-Downer College; Aaron F. Shull, University of Michigan; Leroy D. Swingle, Nebraska Wesleyan University.

Eastern Branch—Thomas Barbour, Harvard University; M. T. Burrows, Cornell University Medical College; H. S. Colton, University of Pennsylvania; E. D. Congdon, Cornell University Medical College; Henry Fox, Ursinus College; Leland Griggs, Dartmouth College; Mary J. Hogue, Mt. Holyoke College; M. H. Jacobs, University of Pennsylvania; H. G. Kribs, University of Pennsylvania; C. V. Morrill, New York University and Bellevue Hospital Medical College; H. D. Reed, Cornell University; A. H. Wright, Cornell University.

The following committee was appointed to consider during the ensuing year the problem of the organization of the society, and to prepare a new constitution: H. V. Wilson, chairman; E. G. Conklin, G. A. Drew and R. G. Harrison (Eastern Branch); F. R. Lillie, W. A. Locy and M. M. Metcalf (Central Branch).

The following papers were presented at the meeting, either in full or by title:

The Sense of Smell in Necturus maculatus: R. E. SHELDON, University of Pittsburgh.

Conjugation and its Significance in the Ciliate, Didinium: S. O. MAST, Johns Hopkins University.

Didinia about to conjugate decrease nearly three fourths in size, and the anterior ends become considerably flattened. They find each other by random movements, join anterior end to anterior end and remain together from four to twelve hours or longer, depending largely upon the tem-

perature. The nuclear changes are similar to those found in *Paramecium*. A large percentage of exconjugants usually die, but sometimes all live. The proportion of fatalities is essentially the same in small individuals taken from the same culture but not allowed to conjugate, while large individuals nearly all live. There is no evidence indicating that there is any difference in the vitality of the two individuals of conjugating pairs foreshadowing sexual differentiation, as held by some investigators. The rate of fission is apparently not affected by conjugation, and if there is a rhythm in the rate of division, such as has been described for certain other infusoria, it is independent of conjugation as is shown by the following results. In seven closely related families under the same environmental conditions the rate of fission was practically the same during a period of several weeks, although the number of generations since conjugation at the close of the experiment varied in the different families from 123 to 553. Conjugation is almost invariably accompanied by encystment, *i. e.*, when certain individuals in a culture conjugate others encyst. This seems to indicate that conjugation, like encystment, functions in bridging over periods of unfavorable environmental conditions. Conjugation produces an increase in physiological variability; some of the exconjugants consequently have a better chance to survive under adverse conditions than do those which have not conjugated.

Behavior of Fire-flies (Photinus ardens?) with special Reference to the Problem of Orientation: S. O. Mast, Johns Hopkins University.

The fire-flies studied are found in dark crevices or under ground during the day. In the evening when it is still light enough to read they come out; the females crawl to the tips of grass or other objects and remain quiet; the males fly about and glow fairly regularly at intervals of about five seconds. The females do not glow unless light from the males or from some other source is flashed on them. When a female glows in response to the glow of a male, the male ordinarily turns directly toward her. This is repeated until the two come together, after which copulation takes place. There are no other factors involved in mating. If a female is held near a male he pays no attention to her unless there is actual contact, showing that neither objective vision nor smell is functional in mating. The males do not orient when exposed to continuous illumination. They respond only to flashes of light, and do not react until after the light has disappeared. Thus orientation may take place in total darkness, and it is surprising how accurately these animals turn through the proper angle in the total absence of the stimulating agent that caused the response. Here we have a case in which it is clearly demonstrated that light does not act continuously in the process of orientation as demanded by Loeb's theories, a case in which it is also clearly demonstrated that continuous stimulation is not necessary to keep the organism oriented.

Expermients with the Influence of Darkness upon Pigment Development in Amphibian Larvæ: A. M. Banta, Station for Experimental Evolution.

From newly laid eggs series of *Amblystoma tigrinum* were reared (1) in darkness and (2) in ordinary laboratory light, and compared with those developing (3) in the pool where the eggs were laid. The amount of pigment developed in each individual of the different series was determined by means of color tops, and records were made in terms of the percentages of black, white, orange and yellow, which when blended matched the color of the animal's skin. For the salamanders on the average the body color of the series reared in darkness contained 49.7 per cent. black and 50.3 per cent. non-black (16.9 white, 9.3 orange and 24.1 yellow); the series reared in laboratory light averaged 86.1 black and 13.9 non-black (4.7 white, 2.4 orange and 6.8 yellow); and the series examined from the outdoor pool averaged 86.6 black and 13.4 non-black (4.5 white, 3.1 orange and 5.8 yellow). Hence the salamanders reared in darkness contained about four times as much non-black in the body color as those reared in daylight in the laboratory or in the outdoor pool where the eggs were laid. The darkest individual in the series reared in darkness, with 70.5 black, was much lighter than the lightest, with 82 black, of either of the series reared in the light.

To be published in full in *The American Naturalist*.

A Comparison of the Light Reactions of a Subterranean and an Epigeal Race of an Amphipod Species: A. M. Banta, Station for Experimental Evolution.

The Spawning Habits of the Sea Lamprey, Petromyzon marinus: L. Hussakof, American Museum of Natural History.

The observations were made on the Nissequogue River at Smithtown, Long Island, June 1 and 2,

1911, while collecting material for an exhibition group of *Petromyzon* for the American Museum. The nests are depressions in the gravel of the river-bottom, two to three feet in diameter, and six inches deep at the center. The method of their construction and the general behavior of the specimens on the nest are very similar to those of the Brook Lamprey. But owing to the large size of this species all its movements can be minutely observed.

To be published in full in *The American Naturalist.*

On the Factors that Determine the Location of the Borings of the Yellow-bellied Sapsucker on the Paper Birch: MARGARET W. TAGGART, University of Illinois. (Introduced by Jacob Reighard.)

The aim of the present study is to determine the details of the work of the yellow-bellied sapsucker (*Sphrapicus varius varius*) upon the paper birch (*Betula alba paprifera*). The borings of the sapsucker on the birch are distributed in several separate areas on a single tree. These individual holes are arranged in definite rows: they are distinct, small, numerous and are rarely confluent. The birds as they excavate eat the sap and cambium of the tree and also the insects attracted by the liberated sap. The factors involved in an explanation of the distribution of the groups of holes and in the shape and arrangement of the individual borings are two—the woodpecker instinct to bore holes and the mechanical conditions under which the bird works. The mechanical conditions resolve themselves into: (1) The perching of the bird. The sapsucker perches on knots and rough places on the bark, rather than on the smooth bark, and uses the excavations it has made in preference to the knots, because they afford a firmer foothold. (2) The structure of the bark. The shape of individual holes and the arrangement of series of holes in vertical colums is determined by the structure of the bark. (3) The use of the cambium as an article of diet. A flow of sap is released by the use of the cambium as an article of diet. The sap attracts insects as a purely incidental result of the bird's work. (4) The cleaning up of all the cambium around the edges of the holes. The large denuded areas are formed as an accidental accompaniment to cleaning up all the cambium around the edges of the holes, and may or may not appear on a given tree. Any explanation, therefore, which involves instinct or intelligence, more than the general woodpecker instinct to make small holes, is unnecessary. The external factors are an adequate explanation of the facts in the case.

Provisional Tabulation of Some Brain Collections with Special Reference to their Usefulness for Taxonomic Purposes: BURT G. WILDER, Cornell University.

The Brain of the New Goblin Shark: WILLIAM A. LOCY, Northwestern University.

Control by the Sympathetic Nervous System and its Morphological Basis: ALBERT KUNTZ, University of Iowa.

To be published in the *Journal of Comparative Neurology.*

Nervous and Non-nervous Responses of Actinians: G. H. PARKER, Harvard University.

A few seconds after a mechanical or a chemical stimulus has been applied to the ectoderm of the lower part of the column of a sea-anemone (*Metridium marginatum*), the animal will respond by contracting the longitudinal entodermic muscles of the mesenteries, whereby the oral disk becomes retracted and ultimately covered by the action of the ring-muscle. The fibrillar layer in the base of the ectoderm and entoderm, believed by the Hertwigs to be the nervous layer, does not offer an easy means of explaining this reaction, since it does not connect the ectoderm in any direct way with the longitudinal mesenteric muscles. Neither does this layer become stained or impregnated by any of the ordinary methods used for the demonstration of nerve-cells or neurofibrils. By a modified silver method devised by Dr. E. G. Titus, a rich system of neurofibrils can be demonstrated in the supporting lamella of the column. These fibrils penetrate the ectoderm and reach through the supporting lamella of the mesenteries to the longitudinal mesenteric muscles. They are the essential nervous elements in the retraction reflex just mentioned.

When a sea-anemone is cut nearly in two, nervous transmission from one piece to the other can be accomplished through almost any part of the body of the animal except the lips. Yet in the lips the so-called nervous layer of the Hertwigs is as well developed as in any other part of the body. This layer, therefore, probably is not the true nervous system; the true nervous system consists of the nervous elements imbedded in the supporting lamella. The layer described by the Hertwigs as nervous is composed of the fine basal branches of the epithelial cells and may be a mechanism for

the absorption of nourishment from the fluids of the intervening spaces.

If a mechanical stimulus is applied to the middle of the column of a *Metridium*, in somewhat less than a minute a well-marked constriction encircles the animal, due to the contraction of the circular muscles of the column. This constriction will occur on a column whose ectodermic surface has been anesthetized with magnesium sulphate to such an extent that the characteristic retraction reflex can not be called forth from it. It is therefore probably a non-nervous direct response of the muscle comparable to the direct responses already demonstrated in the muscles of some sponges.

The Structural Changes during the Contraction of Mollusk Muscle: Ulric Dahlgren, Princeton University.

The Organs of Equilibration in Pelecypod Mollusks: Ulric Dahlgren, Princeton University.

Preliminary Chemical Studies on Male and Female Producing Eggs of Pigeons: A Study of the Eggs of Forms in which the Dominance of Male and Female Sex and of White and Dark Color was Experimentally Determined by Professor C. O. Whitman: Oscar Riddle, University of Chicago.

Much more important than the results of these preliminary chemical studies are the hitherto unannounced facts upon which the studies are based. One of the remarkable results achieved by Professor Whitman in his work with pigeons is the experimental control of the *sex* and *color* of the offspring of certain crosses of pigeons. That is to say, one and the same pair of birds can now be made to produce only dark male offspring—in spring and early summer, and when birds are young and in full reproductive vigor; and likewise only white female offspring—in late summer and autumn, and when birds are very old. The method consists simply in the choice of birds of known age and vigor for the matings, and then *removing their eggs as fast as laid to other birds—thus forcing the birds throughout the year to their maximum of egg-production.* All of the first several pairs of eggs produce dark male hybrids; while all of the last several pairs produce white female hybrids. A short transition period intervenes in which the sex and color of the progeny can not be foretold. There is usually a final period in which eggs are produced capable of little, and of *no* development. Birds thus treated over a period of years show that fewer and fewer males are produced each succeeding year, and that the *time* of appearance of female-producing eggs is moved more and more toward the beginning of the season. Finally, matings of very old birds can be made in which it can be definitely foretold that *only* white female offspring will be produced. These results have been verified yearly since 1903. It is necessary of course to mate individuals of two different species, varieties or hybrids (one bird *dark* the other *light* if color is to be controlled) for such control. Four pure species (reciprocal crosses) and four different kinds of hybrids were successfully used in this way. Stated in Mendelian terms—terms which Professor Whitman did *not* think it well to use—he was able to shift, control or determine experimentally the dominance of sex and color. Aside from the fact that this discovery by Professor Whitman furnishes a starting point and a background for my chemical studies, it unfortunately seems necessary to emphasize at this time, that, although Professor Whitman had never announced this result, he had obtained it as early as 1903; and that this result —confidentially communicated—has been well known to his colleagues at the University of Chicago practically since that time.

The result of a limited number of parallel incubations and analyses made in 1911 on the male-producing and female-producing eggs obtained from the above-mentioned crosses indicate (number too small for final decision): (1) That eggs of *smaller size, higher water content* and *smaller energy content* (*i. e.*, fewer units of physiologically available energy) can be *correlated* with *maleness* and *dark color* in the offspring. (2) That eggs of *larger size, lower water content* and *greater energy content* can be *correlated* with *femaleness* and *white color* in the offspring.

On a Relation Found to Exist between Changes in the Chemical Composition of a Membrane and Changes in its Permeability: Oscar Riddle and Adelaide A. Spohn, University of Chicago.

The follicular membrane can be taken for analysis at three different phases of its normal permeability to the constituents of yolk, viz: (1) When these constituents are penetrating the membrane very slowly; (2) when a sudden and very great increase in this rate of penetration occurs; and (3) the period following this increase and during which the greatly increased permeability is also accompanied by a rapid proliferation of the component cells of the membrane. Analyses show that in phase (1) when the permeability and

growth of this membrane are moderate in amount, the lecithin content of the membrane is of medium value (9 per cent.). At phase (2) the lecithin content is high (15–23 per cent.). During phase (3) the lecithin content again assumes a medium value (8.5 per cent.). The fat content is much lowest at phase (2) (=traces). In phases (1) and (3) this figure is 6 per cent. and 7 per cent., respectively. It has been shown that these values are not produced by variable amounts of contaminating yolk. The results seem to lend some support to Overton's theory of the lipoid nature of the cell membrane; and indeed to indicate that that theory may be extended so as to apply to a *membrane of cells*. At any rate, here is one case where changes in degree of permeability of a *cellular* membrane to *substances rich in fat* (yolk) are preceded or accompanied by a change in the lecithin content of the component *cells* of the membrane.

Some Chemical and Hybridization Experiments in Invertebrates: MAX MORSE, Trinity College.

A number of crosses were attempted at the Harpswell Laboratory, South Harpswell, Maine, between the nemertean, *Cerebratulus,* and various invertebrates, such as *Echinarachnius, Ilyanassa, Strongylocentrotus* and others, both by simple mixing of eggs and sperms and by the application of hypertonic solutions and other reagents known by previous experiments to cause polar bodies to form or even to induce the earlier morula divisions of the egg. Of the several crosses attempted, only one was in any degree successful, this being *Cerebratulus* egg by *Ilyanassa* sperm, the polar bodies being extruded and the earlier segmentations passed through. However, even here it was found impossible to prolong the growth of the embryo to gastrulation, although temperature, salinity, alkalinity and other factors were considered. The cross in question was checked against errors in manipulation, contamination, etc. No experiment made according to the methods of Godlewski, Kupelwieser, *et al.,* where excessive amounts of sperm were used, were successful, nor were experiments involving normal fertilization, preceded by or followed by hypertonic or other parthenogenetic reagents, successful in causing even polar bodies to form. Hence *Cerebratulus* is similar to several other forms where attempted hybridization was found to be futile.

A Comparison of the Retardation Produced by Rapid and Slow Electrons (Beta Radiations) of Radium in the Growth of Various Seedlings and a Consideration of the Relative Importance of Chemical and Physical Factors in the Process: E. D. CONGDON, Cornell University Medical College.

The method of comparing the effect of the rapid and the slow electrons consisted in the exposure of one lot of dry seeds (*Synapis nigra, Panicum germanicum, Amaranthus monstrosus, Nicotiana tobacum* and *Papaver somniferum*) to rapid electrons and another lot to a like intensity of rapid electrons plus secondary slow electrons coming from a lead tube. Both sets showed a retardation which decreased in amount with shortened exposure. The slow electrons had one fourth as great ionizing power in the air as the rapid electrons. Their retarding effect, however, was much greater than one fourth that of the rapid. In one case it was twice as great. Therefore, when very small seeds are taken so that the non-penetrating electrons can distribute their effect through the whole seed, the slow electrons, relative to their ionizing power in the air, are much more biologically effective than the rapid. It was also found that absence of seed coat increased greatly the effect, not only of the slow (non-penetrating) but of the rapid (penetrating) electrons. The placing of the embryo side of the seed toward the radium had a like effect. Those seeds with the greatest diameter were least retarded, and *vice versa.* Thus even in such small organisms, the largest having a diameter of only 0.67 mm., factors governing absorption play a great rôle in determining their sensitiveness. To determine the importance of chemical make up, pairs of seeds of like diameters but very unlike constitution as to starch and fat were exposed. The testa had been removed and the embryos all turned toward the radium. The pairs of species having seeds of like diameters showed almost identical degrees of retardation. The differing sensitiveness of the species here used must then be referred to physical rather than chemical differences in the seeds.

Studies in Developmental Energetics. I. *The Changes in Chemical Energy during the Development of Fundulus heteroclitus:* OTTO GLASER, University of Michigan.

Studies on the Artificial Production of Grafted and Multiple Embryos: A. J. GOLDFARB, College of the City of New York.

By a modification of the Herbst method of treating sea-urchin eggs, it was possible to produce either (1) fertilized eggs without their membranes, and with the blastomeres completely separated, (2) the same but with the blastomeres only partially

separated, (3) the loose union of one or more eggs or parts thereof, (4) the greater or less fusion of one and one half to sixteen or more eggs into one large complex.

Observations upon living and preserved materials clearly showed the nature of the subsequent history depended upon the nature of the union of the component eggs. When eggs or parts of eggs were either partially separated or brought in loose contact, the development of the component eggs was independent, showing no influence of the one upon the others. Two or more normal plutei resulted, either separate or welded together into twins. A very considerable number showed varying stages in the fusion and regulation whereby several blastulæ or gastrulæ were reorganized into one giant or irregular single blastula, gastrula or pluteus. These changes involved interesting regulatory processes in the skeleton, gut, size, shape, etc., of the individual eggs. They also showed an independent rate of development with a frequent dominance of one and the gradual reduction and disorganization of the other eggs in such a partially fused mass of eggs.

Common Atypical Embryos and the Diverse Methods by which they are Produced: A. J. Goldfarb, College of the City of New York.

The Influence of Magnesium Chloride on the Fertilizing Potential of Spermatozoa: R. A. Budington, Oberlin College.

The sperm of *Arbacia punctulata* was used. This was treated for various lengths of time (5 to 80 minutes) with different solutions of MgCl in sea water; .1, .2, .3, .4, .5 and .6 gm. solutions were employed. Such sperm was then used in artificially fertilizing eggs of the same species, two questions being kept in mind, viz., (*a*) Will such sperm cause earlier cleavage of eggs than will normal sperm? (*b*) Will such sperm fertilize a larger percentage of eggs than will normal sperm? A positive result was obtained for the first problem when sperm were exposed to weak solutions for 5 to 15 minutes. As to the second problem, no marked increase in relative number of eggs fertilized, over the proportions shown by the control, could be detected.

The complete paper will probably be published in *The Biological Bulletin.*

The Effect of Narcotics upon the Development of the Hen's Egg: A. M. Reese, West Virginia University.

To be published in Science.

Effect of Commensal Plant Cells in Altering the Rate of Starvation in Scyphomedusæ: Alfred G. Mayer, Carnegie Institution of Washington.

The scyphomedusa *Cassiopea xamachana,* of Tortugas, Florida, is infested with Zooxanthellæ, which when exposed to daylight operate through photo-synthesis to fix the carbon given off as a result of the medusa's metabolism, and at the same time to set oxygen free, thus serving as an efficient aid to the vital processes of the medusa. If the medusæ be maintained in darkness, the zooxanthellæ are rendered inactive, and the medusa starves more rapidly than if exposed to the diffuse light of the laboratory. In darkness the course of starvation is represented by the formula

$$y = W(1-a)^x,$$

where y is the weight upon any day x after starving has begun, and W is the original weight when starving began. a is the index of starvation, for it increases as the rate of starvation increases. When the medusæ are starved in darkness, a ranges from .075 to .205, but in diffuse daylight it is less, varying from .046 to .15. When the medusæ are starved in diffuse daylight they lose weight more slowly than if in the dark, and the formula for starving in the light may be represented by

$$y = W(1-a)^x + \Delta\left(\frac{w + w(1+\beta-\theta)}{2}\right) \times [(1-a)^{x-1} + (1-a)^{x-2}(1+\beta-\theta) + (1-a)^{x-3}(1+\beta-\theta)^2 + \text{etc.} \ldots (1-a)^{x-x}(1+\beta-\theta)^{x-1}] + w(1+\beta-\theta)^x,$$

where w is the original weight of plant cells in the medusa, β their coefficient of increase, θ their coefficient of mortality, and Δ the coefficient of assimilation of these cells by the medusa. The medusæ may be starved 41 days, and still remain alive when their weight has been reduced to one hundredth of its original mass. If starved in sea-water which has been sterilized by heating to 72° C., and then cooled to normal temperatures, the medusæ lose weight about 1½ times more rap-

	Movements Cease at	Temperature of Greatest Activity	Movements Cease at	Death Occurs at
Aurellia from Tortugas	7°.75 to 11°.8 C.	About 28° C.	36°.4 to 38°.4	38°.5
Aurellia from Halifax, Nova Scotia	—1°.4	18° to 23°	29° to 29°.7	29° to 30°

idly than if starved in sea-water which has been passed through filter paper but not heated. This leads one to suspect that Pütter's "dissolved food" in sea-water may not be available unless some bacteria or other organisms be present in the sea-water to stimulate or maintain a synthesis of the inorganic ingredients of sea-water that may result in building up the animal body. In other words, sea-water as such may not be a nutrient fluid for animals unless acted upon by certain plant-like organisms in the immediate presence of the animal itself. As a side issue of this research, it appears that the so-called "converse relation between ciliary and muscular movements" in ctenophores, trochophores, veliger larvæ, etc., is not a chemical but merely a mechanical matter. When the muscles contract pressure is brought to bear upon the ciliated cells, and this renders them relatively insensitive to stimuli and the cilia stop; *vice versa* when the muscles relax, as under the influence of magnesium, the normal stretching of the cilia-bearing epithelium is reduced and the cilia are free to beat incessantly, as do isolated cilia-bearing cells when mechanically torn away from the epithelium and set free in the water.

This paper may appear in the forthcoming volumes of "Researches from the Tortugas Laboratory of the Carnegie Institution of Washington."

The Temperature Reactions of Medusæ Ranging from Temperate to Tropical Oceans: ALFRED G. MAYER, the Carnegie Institution of Washington.

In species of *Aurellia, Limulus* and *Pennaria* which range from cold to warm seas, it is found that individuals living in the tropics have a higher optimum and a higher death temperature than have those living in cold seas. Also the individuals in the tropics can not withstand such low temperatures as do individuals of the same species in cold seas. For example, consider the case of *Aurellia aurita,* the common scyphomedusa, which ranges from pole to pole and is found in all oceans: *Aurellia aurita* from Tortugas, Florida, is killed if frozen into the ice, but specimens from Halifax, Nova Scotia, survive this treatment.

A strictly tropical medusa, such as *Cassiopea frondosa* is killed at from 8°.2 to 9°.7 C., but it continues to pulsate up to about 38°.3–40° C. Evidently it could not survive in cold seas, and this may account for the fact that not a single species of *Cassiopea* has ever been found in the temperate regions. On the other hand, a form confined to arctic or cold seas, such as *Cyanea arctica* from Halifax, Nova Scotia, pulsates until frozen into the ice, a treatment which causes it no apparent injury. On the other hand it is killed by 30° C. Thus it could not survive in the surface waters of the tropics and no *Cyanea* has yet been found in tropical waters. On the other hand the case of *Limulus* shows us that temperature resistance is by no means a sole factor in determining the geographical range of animals, for on the Massachusetts coast *Limulus* remains active from —1°.1 to 41° C. and at the Marquesas Keys in Florida from 0.8° to 45°.7 C. Yet it ranges only from Maine to Yucatan, and all attempts to introduce it upon the coast of Europe have failed.

This paper may appear in the forthcoming volume 5 of "Researches from the Tortugas Laboratory of the Carnegie Institution of Washington."

Symmetry in Regeneration: HERBERT W. RAND, Harvard University.

When a bilaterally symmetrical metazoan is bisected in a plane oblique to its long axis, regeneration, if it occurs, takes place in such manner that asymmetry, in the ordinary geometrical sense of that word, persists until regeneration is nearly or quite completed. The literature dealing with such experiments contains many descriptions which indicate or suggest that the new part, in the earlier stages of its regeneration, lacks, as regards form and organization, coordination with the old part; and that coordination of new and old parts to constitute a normal whole is secondarily effected by means of organogenetic and regulatory processes.

These descriptions give rise to misconceptions regarding the true nature of the regenerative process. A reinvestigation of regeneration from oblique surfaces in planarians reveals evidence that the new material is, from the very beginning of the regenerative process, in the highest degree coordinated with the old. While, during regeneration, the total material is asymmetrical in a geometrical sense, nevertheless a perfect organic symmetry exists in the sense that such materials and energies as are present are distributed upon either side of a morphological median surface (not a plane surface) with precise regard to a certain completeness of plan which remains to be worked out only in a quantitative way. This unity of organization certainly exists from the moment when the formation of new tissue begins—perhaps even before regeneration is outwardly manifested.

The Larva of Sarcophaga, a Parasite of Cistudo Carolina, and the Histology of its Respiratory Apparatus: Wm. A. Kepner, University of Virginia.

This *Sarcophaga* has only been observed three times. Packard discovered it first. He took it to be an Œstrid larva. Wheeler later succeeded in raising imagines from the larvæ and found that the flies belonged to the genus *Sarcophaga*. A careful study of the larvæ taken from a *Cistudo Carolina* in Virginia also revealed that these were larvæ of a *Sarcophaga* and not those of an Œstrid. The anterior stigmata are laterally compressed fan-shaped processes. Each stigma represents for the most part a proliferated mass of the two-layered cuticle of the general surface. At its wide free end the anterior stigma bears 16 to 18 finger-like papillæ. At the tip of each papilla there is a pore which opens into a branch of the lumen of the stigma. The lumen of this anterior stigma is filled with a finely reticulated plug of chitin. Just as the tænidia of the main trachea are given off by the inner, denser cuticular lining of the trachea so the reticulated plug is given off by the inner, denser layer of the cuticular substance of the anterior stigma. The larvæ spend three or four days in emerging from the skin of the host. It is inferred that during this time the anterior stigma are functional, and that the reticulated plugs act as bacterial screens for the two main tracheal trunks.

The complete paper will be published in the *Biological Bulletin*.

The Intra-uterine Embryo of the Bonnet-head Shark, Sphyrna tiburo: E. W. Gudger, State Normal College, Greensboro, N. C.

This shark is viviparous, but viviparity is not attained by a villous uterus secreting a "milk" as in *Dasyatis say* and *Pteroplatea maclura*, two rays common on our Atlantic coast. The inner mucous lining of the uterus is separated from the outer muscular coat by a fibrous spongy material, hence considerable growth of the embryos may take place before any distension of the outer wall is necessary. The embryos in the fish captured measure 50 mm. in length. They lie nested in the cavity of the uterus, each in a separate spindle-shaped compartment or depression in the mucous lining. The embryos have a large number of external gill-filaments 15–18 mm. long protruding from the gill-slits. The umbilical cord is about 50 mm. long and is closely beset with what Alcock has called "appendicula," large clear villi-like structures, sometimes single, sometimes forked. The yolk-sac is large and flat. Each egg with its embryo is contained within a very thin but tough and elastic membrane, highly iridescent in appearance. The ends of this shell are curiously plaited and folded and when unfolded the shell becomes of great length. The purpose of this seems to be to accommodate the growing embryo, since Alcock found the 18-inch young of *Zygæna blochii*, the Indian Hammer-head, still enclosed in the shell. The same authority reports that the emptied yolk-sac becomes adherent to the wall of the uterus and thus becomes a functional placenta. The embryos under consideration are too young to show anything of this kind. The function of the "appendicula" is not known. The data given are from a shark studied at the Beaufort, North Carolina, Laboratory of the United States Bureau of Fisheries.

This abstract represents a part of a paper on "Viviparity in Beaufort, N. C., Sharks and Rays," which will probably be published in the *Bulletin of the U. S. Bureau of Fisheries.*

Amitosis in Testes of Tænia Serrata: R. T. Young, University of North Dakota.

Occasional evidence of amitosis is found in early stages of these organs, consisting in (1) cells which show distinct incisions of the cytoplasm, (2) cells with straight or nearly straight edges separated by narrow spaces, as though recently broken apart, and (3) bi-nucleate cells constricted between the nuclei.

Epithelium of Plathelminths: R. T. Young, University of North Dakota.

To be published in the *Journal of Morphology.*

Some Uses of Celluloid in the Biological Laboratory: J. S. Kingsley, Tufts College.

Small skeletons like those of the frog and *Necturus*, bleached tests of sea-urchins, etc., are sure to be quickly destroyed by students unless protected in some way. For some years I have used boxes of glass, fastened together with paper or tape, for this purpose, but recently, acting on a hint from Dr. Gast, of the Naples Zoological Station, I have made the boxes of transparent sheet celluloid, sometimes with one side of glass. The celluloid is such as is employed for automobile wind-shields and comes in sheets measuring 20 by 36 inches. The thickness is accurately gauged and is in multiples of 5/1000 of an inch. I have mostly employed 10/1000 and 15/1000, the cost of the former being 75 cents, the latter $1.00 a sheet.

The celluloid is cut with the shears to the required size and shape and the boxes are built by cementing the edges of the sheets by bringing them into the desired position and then moistening them with acetone applied with a small brush. Less than a minute is required for the firm adhesion of the edges. In the same way the celluloid can be fastened to the edges of a light of glass, provided that the edges of the latter be clean. Of course considerable care must be exercised to see that all pieces of celluloid be accurate in size. The details of the operations are not easily described, but a little experience will enable any one to devise methods to meet all cases. The specimen can be fastened to the glass or celluloid by means of scraps of the waste celluloid dissolved in acetone. I have now fluid specimens mounted in "Wilson's oil" and enclosed in boxes of celluloid, built up in the same manner, which have been in good condition for several months. How permanent they will prove, time can only decide. It is impossible to mount them in alcohol or formol as water or alcohol dissolve the camphor and other substances in the celluloid. In the case of Wilson's oil the box must be completely filled or there will be a warping of the celluloid which will break down the box in a few days. I believe that celluloid can be used to fasten the tops to the square museum jars, but I have not tried it. I may suggest that strips of celluloid be fastened to the ground edge of the jar by acetone, the jar be then filled as completely as possible with the preserving fluid without wetting the edge of the celluloid, and then the cover applied, acetone being run in with a brush, and then a solution of celluloid in acetone being painted over the joint. It seems probable that, with such a thin layer of celluloid, there would not be sufficient warping to break the joint. It is often desirable to mount rather thick microscopic objects under pressure. I have used the following process in thus mounting parapodia of annelids. Two narrow strips of sheet celluloid are placed on a slide in the desired position and are then cemented to the slide by running acetone under them. The object, properly cleared, is placed between the strips, and the cover-glass pressed down and fastened in position with acetone run under. In two or three minutes balsam or dammar is drawn under the cover by capillary attraction and the slide is permanently mounted. I may say that the sheet celluloid is to be had in every large city. I have bought my supplies of Willard and Willard, 65 Bedford Street, Boston. The scraps from other operations may be used, instead of gun-cotton or celloidin, for section cutting, being dissolved in alcohol and ether in the customary manner.

Parasites of the Muskrat: F. D. BARKER, University of Nebraska.

On the Number of Known Species of Animals: H. S. PRATT, Haverford College.

The first enumeration of all the species of animals known to science was made by Linnæus in 1758. In the tenth edition of the "Systema Naturæ" he described 4,236 species, which were apportioned among the various larger groups (which are here given their modern names) as follows:

Mammals	183
Birds	444
Birds and Amphibians	181
Fishes	414
Tunicates	3
Bryozoa	35
Mollusks and Brachiopods	674
Crustaceans	89
Arachnids	78
Myriapods	16
Insects	1,936
Worms	41
Echinoderms	29
Cœlenterata	74
Sponges	11
Protozoa	28

About a hundred years later (1859) Agassiz and Bronn made the following enumeration:

Vertebrata	18,660
Mollusks	11,600
Crustaceans	1,500
Arachnids	2,000
Insects	90,000
Worms	1,600
Echinoderms	550
Cœlenterates	1,820
Sponges	290
Protozoa	1,510
	129,530

In Ludwig's revision of "Leunis," published in 1886, the numbers of species are given as follows:

Mammals	2,300
Birds	10,000
Reptiles	2,500
Amphibians	1,000
Fishes	9,000
Tunicates	300
Mollusks	21,320

Crustaceans	5,600
Arachnids	4,000
Myriapods	800
Insects	200,000
Worms	6,300
Echinoderms	2,370
Cœlenterates	3,000
Sponges	600
Protozoa	4,130
	273,220

An estimate of the number of living species known at the present time (1911) gives the following results:

Mammals	3,500
Birds	13,000
Reptiles	3,500
Amphibians	1,400
Fishes	13,000
Tunicates	1,300
Mollusks	61,000
Crustaceans	16,000
Arachnids	16,000
Myriapods	2,000
Insects	360,000
Annelids	4,000
Bryozoa	1,700
Rotifers	500
Nemathelminthes	1,500
Plathelminthes	5,000
Echinoderms	4,000
Cœlenterates	4,500
Sponges	2,500
Protozoa	8,000
	522,400

Some Changes in the Nerve Cells of the Bee during its Life Cycle: W. M. Smallwood, C. G. Rogers and Ruth L. Phillips, Syracuse University.

Ecological Observations in British Guiana and Brazil: Henry E. Crampton, Columbia University. (Illustrated with lantern slides.)

An Early Human Cranium from Unterlesece near Trieste: Harris Hawthorne Wilder, Smith College.

A fragmentary human cranium was exhibited which was excavated during the past summer in a cave in the small Slavic village of Unterlesece, 15 kilometers east of Trieste, Austria. The cavern is a mere cleft, not offering sufficient headroom to allow one to stand, or even sit, except at the very end, and could not have served for a dwelling. The deposits, therefore, consist of the things that have washed in and lodged in the hollows of the floor. They consist mainly of the bones of Neolithic animals, and a few Neolithic shards. This fragment was found, associated with a right ulna, and a small shard of crude workmanship, in a bottom layer of clay, and covered by a distinct layer of loess, with stone fragments from the roof, among which were imbedded bones of the ox, sheep, horse, etc., also many pieces of a human skeleton with worn teeth, as in the American aborigines. The results of the detailed anthropometric measurements, of which 37 were taken, conform closely to certain other ancient skulls of the *sapiens* species, especially those of Egisheim, Cannstatt, Brunn, I. (1885), and probably Tilbury and Sligo. While, however, these latter are pretty definitely Quaternary (Solutrean, Magdalenian), this specimen, as dated by the shard and the general character of the remains in the cavern, must be either Neolithic or Transneolithic (Campignyan, Tardenoisian).

Evidence of Evolution in the Mechanism of Inheritance: Maynard M. Metcalf, Oberlin College.

In some, perhaps in all, of the higher animals and plants the chromatin consists of discrete particles of different functions in physiologic activity and inheritance. These particles are grouped into chromosomes in which, in some species—perhaps in all—they form linear aggregates. There is an elaborate achromatic mechanism of mitosis which aids in securing the distribution of halves (?) of each discrete particle of chromatin to each of the two daughter nuclei. In many plasmodrome protozoa (perhaps in some stage of their life history in all of them) the nucleus contains a caryosome with a definite caryole and an outer membrane delimiting it from the peripheral zone of the nucleus. New granules of chromatin continually form in the caryosome (apparently at the caryole), wander to the caryosome membrane, after a time break through this into the peripheral zone of the nucleus, through which they migrate to reach the caryotheca. Many of these granules in time break through the caryotheca into the cytoplasm as chromidia, there to be dissolved. Apparently any of the granules so formed in the nucleus may become chromidia. The most careful study of these nuclei shows no indication of division of the chromatin granules within the nucleus during this formation of chromidia. Whole granules seem to be thrown off. Such a condition seems incompatible with the existence of a series of "determiners" in the nuclei of plasmodroma. The chromatin seems rather more homogeneous, each particle having the

same physiologic and inheritance value as every other except perhaps for size or density. This condition parallels the general physiological condition in the plasmodroma whose protoplasm shows little differentiation for sensation, conduction, locomotion or specialized secretory activities, each bit of the protoplasm sharing in all these activities. In other protozoa we find several different types of more highly evolved chromatin structure. Some of these, as in *Opalina,* seem not in the line of evolution of the metazoan condition. Others, as in *Paramecium,* have chromosomes which are linear aggregates of granules and which split longitudinally in mitosis. Such a form has a chromatin arrangement which would allow differentiation of the granules into divergent determiners, for a portion of each granule is given in mitosis to each daughter nucleus.

A further discussion of this subject is in preparation. Its place of publication is not yet determined.

Opalina mitotica: MAYNARD M. METCALF, Oberlin College.

This paper, which was read by title only, will soon appear in full in one of the Spengel Festschrift volumes of the *Zoologischer Jahrbücher.*

The Pædogamous Conjugation of Blepharisma: GARY N. CALKINS, Columbia University.

There is some question as to the specific name of the organism with which I am working. Up to the present I have followed Butschli in calling it *B. musculus,* identifying it with the form *Urostyla musculus* described by Ehrenberg. The name *Blepharisma* goes back only to Perty in 1849, who first used it as a generic name for a species of *Spirostomum* described by Ehrenberg again, as *Spirostomum lateritia.* Leaving for the present the taxonomic position of the organism I wish to speak here more particularly of some of the biological phenomena which have come under observation during the five months that I have kept *Blepharisma* under culture. I isolated a specimen in July from pond water at Woods Hole and found that it lends itself readily to cultivation upon artificial media. For the best results a few drops of pond water plus a drop of 24-hour standard hay infusion are now used, a medium upon which the organisms have reached to-day the 160th generation. None of the earlier observers made out a micronucleus and from total preparations alone I was unable to demonstrate it. Upon study of sections of the organisms, however, I have been able to find structures which undoubtedly correspond with a micronucleus in the typical ciliate. The macronucleus is large and comparatively easy to demonstrate, although it has a variety of forms; sometimes it is a single body of spheroidal form, again it breaks up into irregular fragments. On division there are two chief portions, one at either end, and a connecting strand of somewhat different texture and the micronuclei are connected with this. It is the custom of all who carry on careful culture work to isolate one individual and supply it with fresh medium every day. The individuals left over after isolation of the one specimen are placed in larger vessels and kept as "stock." Early in the summer it was seen that endogamous conjugations occurred frequently in this stock material, in some cases reaching the proportions of a general epidemic. So keen at times is this "sexual hunger" as Maupas called it, that conjugation occurs between the closest related cells. For example an individual was isolated in the 104th generation, fresh medium and food being given as usual. On the following day it had divided, but the two sister cells were united in typical conjugation. This, I believe, is the closest relation on record for pædogamous conjugants amongst Infusoria. The cells begin to conjugate at the anterior tips as in *Paramecium* and gradual fusion extends along the peristome for about two thirds of the length and never further, thus leaving the greater portion of the undulating membrane and the mouth entirely free. They remain in conjugation from 12 to 24 hours and separate through vacuolization of the connecting zone of protoplasm. The most remarkable phenomena are connected with the nuclear relations during conjugation on which I can now give only fragmentary notes, as my observations are not completed. The macronucleus becomes compact and spheroidal with a typical "kernspalt" in the center. It is also enclosed in a firm resistant membrane like a cyst, a structure which does not exist at other times. Sections of conjugating pairs show that the nucleus is made up at this time of two main bodies of chromatin of densely granular appearance, while between them long drawn-out rods of chromatin like chromosomes appear to be dividing. This central material gives rise to two smaller nuclei which are freed from the mass of macronuclear material and in the cytoplasm undergo one or two further divisions which result in the gametic nuclei. I have not yet found the pronuclei in the process of fusion, but have seen them in the connecting bridge between the

two organisms. Here then is something entirely novel in the make-up of macro- and micronuclei, the micronucleus being absorbed and protected by the macronucleus. The size statistics of conjugating and non-conjugating forms are similar in essence to those of *Paramecium*. Miss Watters has measused some 1,580 specimens, of which 482 were conjugating. The average size of the conjugants is 110 μ, of non-conjugants 140 μ, the latter including exconjugants which never regain normal size. More than 150 exconjugants have been isolated and maintained from time to time. Not one has lived more than 16 days, the dates being 22 per cent. dead on first day, 31 per cent. on second, 13 per cent. on third and 8 per cent. on fourth, with the rest scattering one or two per day until the sixteenth. This is similar to Bütschli's results with Blepharisma in 1876, when all of the ex-conjugants died within three days after separating. Vitality therefore is not restored by conjugation under the conditions of the experiments; whether it is due to these conditions, due to the pædogamic nature, or due to some other cause remains to be shown.

It is expected that this paper will be published in full in the *Journal of Morphology*.

Actinobolus radians St. and its Cultivation: Gary N. Calkins, Columbia University.

Regeneration in Paramecium caudatum: Florence Peebles, Bryn Mawr College.

The results of a series of experiments on *Paramecium caudatum* show that the power of regeneration varies greatly in different races, and also in individuals of the same race. It usually depends on the condition of the protoplasm, or the age of the individual at the time of the operation. The removal of the anterior one third causes greater disturbance in the cell than the removal of the posterior end. The fragment which is removed always dies, but the larger nucleated piece either regenerates the lost end or divides without regeneration into a normal and an abnormal individual. Regeneration of the anterior end took place in forty per cent. of the cells, while the posterior end regenerated in sixty-three per cent. Cells in the vegetative condition when cut in half form no abnormal individuals. One half dies and the other produces a normal race. It was found impossible by removal of the protoplasm to produce a small race from a large one. After several generations the normal size was restored. Vegetative cells seem to have much division energy stored up within them. Experiments indicate that three division planes are present, so that one cell represents four individuals. The removal of a part of the protoplasm acts as a stimulus, and several divisions follow in quick succession. It was found impossible to cut the macronucleus in vegetative cells so that each fragment contained a part of it. When cells were cut in half during division both pieces received a fragment of the nucleus and formed normal races.

It is expected that this paper will be published in full in the *Biological Bulletin*.

Observations on Synapsis and Reduction: Edmund B. Wilson, Columbia University.

The maturation-phenomena in *Tomopteris* and *Batracoseps* have been reexamined by a study of the original preparations of the Schreiners and of Janssens, as well as of new preparations of *Batracoseps* fixed and stained by various methods. This study has led to a confirmation of the main conclusions of the above-named observers in regard to synapsis. The seriation of the stages is placed beyond doubt by the conditions seen in *Batracoseps*. In both this form and *Tomopteris* the facts seem to admit of no other interpretation than that the "amphitene" or synaptic stage represents a progressive union of leptotene threads, two by two and side by side (parasynapsis), to form pachytene loops of the haploid number; and in the case of *Batracoseps* there is considerable evidence that this process is accompanied by a close torsion or twisting together of the leptotene threads as they unite. This process proceeds from one pole of the nucleus towards the opposite pole. In the opinion of the author it is impossible to admit the interpretation of this process offered by Fick, Goldschmidt, Hæcker and Meves that it is only a modified form of longitudinal splitting. Observations on the Orthoptera (grasshoppers) indicate that a similar mode of synapsis occurs in these animals, though it is less certainly shown than in the other forms. In the pachytene loops resulting from synapsis all traces of duality are usually lost to view, at least for a time. This may be due either to a close twisting together of the leptotene threads or to an actual process of fusion. In either case there is as yet no satisfactory evidence that the plane of the ensuing "reduction-division" is identical with that of the original conjugation. The facts point on the whole to the conclusion that the period following synapsis is one of reorganization of the chromosomes in which a redistribution of their substance may take place. This may be effected by a process of torsion as the chromo-

somes unite, or subsequently, followed by a new longitudinal split in a new plane, as suggested by Janssens in his theory of the chiasmatype. The conception of the "reduction-division" is however valid, since this division reduces the valence of the bivalent to one half, and it fails to take place in the case of univalent chromosomes, as is proved by the history of the sex-chromosomes, *m*-chromosomes and supernumerary chromosomes in the Hemiptera. The explanation of the Mendelian disjunction may be sought in either maturation-division or in both, as has been shown by Janssens.

The Penetration of the Spermatozoon and the Origin of the Sperm Aster in the Egg of Nereis: FRANK R. LILLIE, University of Chicago.

(1) As described in a previous paper,[1] the egg of *Nereis* secretes a large quantity of jelly, derived from spherules of a cortical layer, immediately after contact of the spermatozoon. The perforatorium of the spermatozoon penetrates the vitelline membrane and becomes inserted in a well-marked entrance cone. *Fixation granules,* undoubtedly derived from the spermatozoon, appear at the tip of the perforatorium in the cone. The substance of the cone becomes differentiated by staining reaction and behavior to form an organ definitely concerned in the subsequent penetration of the spermatozoon. (2) The spermatozoon remains external to the egg embedded in the jelly for 45 to 50 minutes after attachment. The head is then drawn by the cone through the vitelline membrane into the egg in the form of a thick strand of chromatin several times the length of the original head of the spermatozoon. *The middle piece and tail remain external,* and may be seen on the vitelline membrane up to the time of cleavage. They never enter. (3) The chromatic thread representing the head of the spermatozoon then contracts to form a vesicular nucleus, still attached by the perforatorium to the cone. Nucleus and cone then rotate through 180° and the sperm aster arises always at the point of the nucleus farthest from the cone, thus in the position of the base of the sperm head. The problem of the origin of the sperm centrosome in the egg is considered in the next abstract. (4) The "fixation granules" are *possibly* cytoplasmic elements introduced by the spermatozoon, though they come from the apex of the spermatozoon. No other demonstrable cytoplasmic elements are introduced by the spermatozoon. (5) After origin of the aster the sperm nucleus separates from the cone, and the latter gradually disintegrates in the cytoplasm. The sperm amphiaster becomes the cleavage amphiaster.

[1] *Jour. Morph.*, 22, 1911.

On the Fertilizing Power of Portions of the Spermatozoon: FRANK R. LILLIE.

If unsegmented eggs of *Nereis* be centrifuged about 60 revolutions of the hematocrit of the Bausch and Lomb hand centrifuge in about 40 seconds, thirty to forty minutes after insemination, the mass of eggs accumulates at the distal end of the tubes and becomes pressed together. The jelly, which is of less specific gravity than the eggs, then separates from the latter and forms a layer above the eggs. In squeezing through the narrow interstices between the closely packed eggs it rubs over the surface of each egg, and in many cases it carries the attached spermatozoon away with it. In other cases, especially if the eggs are centrifuged shortly before the time of penetration of the spermatozoon, it draws out the substance of the head of the spermatozoon, which is very ductile at this time, into a strand; and in numerous cases it carries away the tail and middle piece, or variable portions of the head in addition. Partial sperm-heads of all sizes are therefore left attached to the egg by the perforatorium. Such partial sperm-heads then penetrate, being drawn in by the entrance cone as in the case of normal fertilization, and they form partial sperm-nuclei attached to the entrance cone within the egg. Rotation then takes place and an aster invariably arises in connection with the partial sperm-nucleus at the point most distant from the cone, *i. e.*, at the most basal point of the sperm-nucleus. By using large quantities of eggs and by preserving at various stages one can study all stages of these processes in sections, and the above statements are based upon large numbers of observations. It is therefore proved (1) that the sperm centrosome is inessential for formation of the sperm aster within the egg; (2) the origin of the sperm aster is a nucleo-cytoplasmic reaction; (3) the sperm-nucleus is polarized with reference to this reaction inasmuch as the sperm aster arises always at the most basal point of the partial sperm-nucleus, with reference to the orientation of the nucleus in the sperm head. The conclusion therefore involves the conception of a certain differentiation between egg-nucleus and sperm-nucleus, for the former has no independent capacity of initiating karyokinetic phenomena, whereas the latter has.

The two preceding papers will be published in full in the *Journal of Experimental Zoology.*

Human Spermatogenesis: T. H. Montgomery, Jr., University of Pennsylvania.

The point was made that in man there are four types of probable functional spermatozoa, differing in their content of modified chromosomes. One type has two of these bodies, one has none, one has the larger body only and the other has the smaller only. All primary spermatocytes contain each one larger and one smaller modified chromosome. Further, during the histogenesis of the sperm the cuff of the spermatid is produced from nuclear sap, not from the cytoplasm, and since this cuff substance is thrown away with the abstricted cytoplasm the spermatid loses the greater amount of its nuclear sap. Therefore, this nuclear sap substance can not have the same value in inheritance as the other substances of the nucleus.

To be published in full in the *Journal of the Academy of Natural Sciences of Philadelphia, Centenary Volume.*

The X-element in Guinea-chicken Hybrids: Michael F. Guyer, University of Wisconsin.

The hybrids in question, all male, were the offspring of a black langshan cock and a common guinea hen. The *X*-element of the chicken is very large, of stout build and typically of different shape from that of the guinea. While each usually appears as a curved body, the *X*-element of the chicken is U- or bean-shaped with both ends of the same size, while that of the guinea is more comma- or pistol-shaped, with one end noticeably narrower than the other. The *X*-element of the hybrid was found to be invariably of the maternal (guinea) species type. In this fact may lie a simple explanation of why these hybrids were all male. For in all known cases it is the spermatozoon *without* the large *X*-element which unites with the egg in the production of the new male, and since such a spermatozoon is much smaller than one of the other type, this mere difference in size may be the factor determining which shall fertilize the egg. Hybrids are obtained with difficulty even under the most favorable conditions and we may reasonably suppose that the egg-plasm is more or less resistant or antagonistic to the entrance of a foreign sperm. If such is the case it would seem not improbable that the smaller type of spermatozoon with its diminished quantity of incompatible substance and its lessened surface against which resistance could operate, would penetrate more readily than the other, with the consequent production of a male.

To appear in full in *Journal of Morphology.*

Eight Factors that Show Sex-linked Inheritance in Drosophila: T. H. Morgan, Columbia University.

Eight factors that show sex-linked inheritance have appeared in cultures of the fruit fly, *Drosophila.* These factors without exception follow in their heredity the distribution of the sex-chromosomes with which they may be said to be linked. (1) The red eye of the wild fly is due to three factors—vermilion *V*, pink *P* and orange *O*. Of these *V* is not sex-linked, while *P* and *O* follow the sex-chromosomes. The red eye may be designated by *VPO*, the pink eye by *vPO*, the vermilion eye by *VpO* and the orange eye by *vpO*. Orange is present in all these cases, but since like *P* it is sex-linked (see below), it occurs in duplex in all females and in simplex in all males. The heredity of these eye colors has recently been published.[2] (2) A new color has more recently appeared, due to the loss of the orange factor. The formula for this mutant seems to be *VPo*. The females have darker eyes than the males; thus giving a dimorphic race. The *O* factor proves to be sex-linked. It will now be possible, unless associative inheritance interferes, to produce a new series of reds, vermilions and pinks that lack orange; and an eye that lacks all color determiners, but contains the color producer *C*. (3) White-eyed mutants due to the loss of the color producer *C* have been described,[3] and these may carry the determiners for vermilion, pink or orange, etc. (4) The gray color of the wings of the wild fly is due to three factors—black *B*, yellow *Y* and brown *Br*. The formula for the wild fly is *BYBr;* for the black fly *ByBr;* for the yellow fly *bYBr*, and for the brown fly *byBr*. Of these three factors black, *B*, is sex-limited; yellow, *Y*, is not; and *Br* has not yet dropped out, so that its distribution is unknown. (5 and 6) Two wing mutants, described as rudimentary wings and miniature wings, both show sex-linked inheritance.[4] The miniature wing is due to the loss of a factor *S;* its formula is *Ms*. The rudimentary or "short" wing is *Sm*. When a miniature female is crossed with a short male, all the females (*Ms Sm*) have long wings; all the males (*Ms..*) have miniature wings. When the "short" female is crossed to the wild male all the females (*Sm SM*) have long wings, and the few males that appear have short wings. The females are to the

[2] *Jour. Exp. Zool.*, 1911.
[3] Science, 1910.
[4] Science, 1911.

males as three hundred and eighty-one to three (381:3). (7) The bands on the abdomen, so conspicuous a feature of the normal fly, have been lost in another mutant. The factor is dominant and sex-linked.[5] (8) Another wing mutant has appeared in which the second inner vein fails to reach the margin, often producing a bifid wing, but the shape of the wing is varied. The wings are held out at right angles to the sides of the body. The factor responsible for this condition is also sex-linked. Thus bifid-winged females crossed with wild males give all normal-winged females and bifid-winged males. The reciprocal cross gives normal-winged males and females. These inbred give normal-winged females and males and bifid-winged males.

Supernumerary Chromosomes and Conjugation of Chromosomes in Ceuthophilus (Sp.?): N. M. STEVENS, Bryn Mawr College.

The usual number of chromosomes in the spermatocytes of the first order is 19, eighteen bivalents and the univalent *X* chromosome. In one individual two supernumeraries, and in another one were found. These supernumerary chromosomes behave like those in *Diabrotica soror* and *D. 12-punctata*, dividing sometimes in the first, sometimes in the second maturation mitosis; and they probably originate, as in the *Diabroticas*, in an abnormal division of the *X* chromosome. In *Ceuthophilus* synapsis or conjugation of the chromosomes takes the form of parasynapsis. The chromatin threads pair side by side, twist together and in the prophase untwist. The homologous members of each pair unite end to end, forming compound rods, crosses or E-shaped figures, or they may unite by both ends, forming rings. The first maturation mitosis is a segregation division, the second equational. There is no synizesis stage, and no marked polarization of the chromosomes to form a bouquet stage.

This paper will be published in full in the *Biological Bulletin*.

Chromosome Studies: F. PAYNE, Indiana University.

A continued study of the Reduviidæ throws no further light upon the origin of the irregular chromosome distribution found in that family. In *Pnirontis*, however, is found a type of distribution new to the family and similar to that of *Gelastocoris oculatus*. In *Pselliodes*, which gives another type similar to that of *Prionidus* and *Sinea*, the single chromosome, the homologue of the small idiochromosome, contains a larger quantity of chromatin than the three small chromosomes which go to the opposite pole. In this respect it is similar to the case of *Acholla*. A study of the ovaries of *Gelastocoris* reveals a nucleolus which forms shortly after the last oogonial division and remains until about the time of synapsis. In most cases this nucleolus stains uniformly, but in favorable places darker bodies can be seen within it. It seems probable that these darker bodies are the idiochromosomes, eight in number. In these ovaries the ova can be traced with unbroken continuity from the end chamber to the fully developed eggs.

To be published in full either in the *Journal of Morphology* or in the *Biological Bulletin*.

The Histogenesis of the So-called Apyrene Spermatozoa in Strombus: EDWIN E. REINKE, Princeton University.

The apyrene spermatozoon of *Strombus*, as compared with the eupyrene or ordinary spermatozoon, of this species, is a very large cell with a complex structure. The cell-body is cylindrical and tapering in shape and it is filled with many polygonal bodies which are undoubtedly composed of albumen. These bodies are very regular in outline and are arranged in rows; they vary considerably in size, those in the middle of the cell being larger than those at either end. The breadth of the cell is greatly increased by the presence of two undulating membranes which pass down either side of the cell and meet at the posterior end, where they are drawn out into a long sharply pointed tail-piece. Anteriorly these membranes fuse in the mid-line and give a broad, rounded appearance to this end of the cell. At the very tip, where the membranes meet, there is a darkly-staining cap; this is a centrosomal structure. Lying scattered through the cell and between some of the albuminous bodies are fragments of greatly degenerated nuclear material. The entire length of the spermatozoon is about 90 micra. The apyrene spermatozoa are found to originate from certain large pear-shaped cells which are attached by their narrow ends to the cyst-wall of the testis. These cells are easily recognized and can readily be distinguished from the eupyrene spermatocytes, not only by their size, but also by the presence of a large sphere with strong astral rays. The development of the apyrene spermatozoa from these cells is direct, that is, no cell-division occurs during their histogenesis; the nucleus simply breaks down, scattering nuclear fragments throughout the cell. These fragments immediately begin to degen-

[5] *Proc. Soc. Exp. Biol. and Med.*, 1911.

erate and play no further active part in either the developing or the adult spermatozoon. At the time of the breaking down of the nucleus, the large sphere with its astral system disappears, leaving only the contained centrioles and a mitochondrial mass which surrounded it. There are a great many of these centrioles and, lying close together at the periphery of the cell, they very soon divide and one half of the resulting granules begin to move across the cell. In this way a large bundle of very thick axial fibers is formed and its subsequent growth greatly increases the length of the cell. Before it has reached its full growth, however, the bundle splits down its long axis. Continued growth causes each half of the bundle to pass to opposite sides of the cell. Here, by fusing and pushing out the cell wall, they eventually form the undulating membranes. The albuminous bodies first appear a short time before the bundle of axial fibers begins to split. They are formed by the filling up with albumen of previously existing vacuoles. At first these bodies are spherical, but later, through crowding, they become polygonal. The foregoing facts, relative to the development and the adult structure of these cells, would indicate that their function, if any exists, must be widely different from that of the ordinary spermatozoa. Indeed, the evidence at hand is almost strong enough to make the application here of the word spermatozoon, in its specialized meaning, a misnomer.

Reinvigoration Produced by Cross Fertilization in Hydatina senta: David D. Whitney, Wesleyan University.

A report of experiments was given in which Dr. Whitney has reared rotifers for five hundred generations by the parthenogenetic method. The females of each generation laid eggs and these at once without fertilization by a male grew into females for the succeeding generation. Dr. Whitney observed two long experiments for about three years and found that these animals gradually became weaker and weaker by this maleless method of reproduction and finally died out from general weakness if the experiments were carried on long enough. One of the races lived for 385 generations and the other is still alive in the 503d generation, but is in a very weak condition. When both races were alive and had reached a weakened condition males were produced from them and some inbreeding experiments were made in which eggs were fertilized by the sperm of the males of the same race. This was done in order to determine whether fertilization would bring the race back to normal vigor. Several successive inbreeding experiments were made and only resulted in a slight amount of reinvigoration of either race. However, when the two weak races were crossbred a great amount of reinvigoration occurred at once and the resulting race was as vigorous as any young normal race.

To be published in full in the *Journal of Experimental Zoology.*

External Agents and the Growth Period of the Egg in Hydatina senta: A. F. Shull, University of Michigan.

It is not possible to reduce the proportion of male-producers in this species of rotifer by transferring to manure solution eggs that have been laid in spring water, even though the manure solution is strong enough to exclude male-producers when the rotifers are bred continuously in it. The nature of the females is determined, therefore, before they hatch. A female that has already produced some male-producers, ceases almost immediately to yield male-producers if she is placed in manure solution. A female that has produced part of her family (all female-producers) in manure solution, may commence to bring forth male-producers almost immediately if she is transferred to spring water. The kind of female which will hatch from an egg is determined, therefore, within a period of two or three hours before the egg is laid. This period includes the entire growth of the egg and the formation of the single polar spindle.

The complete paper will appear in the *Journal of Experimental Zoology.*

Notes on the Inheritance of Barring: H. D. Goodale, Station for Experimental Evolution.

Some Reactions of Drosophila to Parallel Rays of Light: H. G. Kribs, University of Pennsylvania.

The *Drosophila* were placed in a tube 8 inches long and about 1⅛ inches in diameter. When placed in the light with the axis of the tube parallel with the rays no characteristic reaction could be observed. When the axis of the tube was tilted to an angle of about 45 degrees to that of the rays the flies at once showed their characteristic orientation. When, however, the ommatidia forming the central mass of the eye were painted over, the flies no longer reacted in the normal way when the axis of the tube was placed at the 45-degree angle, but would do so when it was placed parallel to the rays of light.

The following communication from a member of the society was received by the secretary too late for presentation at the Princeton meeting:

A Peculiar Structure in the Embryo of the Honey Bee: JAS. A. NELSON, U. S. Department of Agriculture.

In embryos from fertilized eggs of the honey bee, at the time when the germ layers are forming, but before the lateral folds have begun to unite, a small lenticular mass appears on the dorsal side of the egg, close to the cephalic pole. Its outer surface is almost plane, its inner strongly convex and studded with numerous delicate processes which join with the protoplasmic meshwork of the interior of the egg. This mass, which will be termed provisionally the cephalo-dorsal disk, appears to be a syncitium, composed of rather clear and vacuolated cytoplasm, within the inner half of which numerous nuclei are embedded. It lies at the surface of the egg and is continuous at its edges with the surrounding blastoderm. This structure was first noticed in 1904 by O. Dickel, who called it the "yolk plug." Dickel identified the point in the blastoderm where it first appeared as the blastopore, described the disk as formed by the migration of yolk cells to this point, and sought to connect it with the rudiments of the mesenteron, in an endeavor to interpret the process as gastrulation. A study of the antero-dorsal disk in sections of eggs of various ages shows: (1) that the so-called yolk plug does not arise from yolk cells, but from the blastoderm of the dorsal side of the egg by a cephalad migration of its cells and their aggregation at this point; (2) that at no time has the cephalo-dorsal disk any connection with the rudiments of the mid-intestine; (3) that during the stages immediately following the formation of the germ layers it becomes broken up into amœboid cells which wander off into the yolk at the cephalic end of the embryo. It therefore appears to be a center of distribution for cells from the blastoderm to the yolk. Its homologies are obscure, although Hirschler (1908) has described a somewhat similar structure which he called the "dorsal organ," in the egg of the chrysomelid beetle *Donacia*. It is also interesting to note that the cephalo-dorsal disk has, in its position, time of appearance and structure a very close resemblance to the cell mass described by Petrunkewitsch in the drone egg as derived from the polar bodies and later forming the male sex cells.

The following exhibits were made during the meeting of the society:

An Early Human Cranium: H. H. WILDER, Smith College.

Microscopical Preparations of Epithelium of Plathelminths: R. T. YOUNG, University of North Dakota.

Microscopical Preparations to Show Amitosis in the Testis of Tænia serrata: R. T. YOUNG, University of North Dakota.

JOHN H. GEROULD,
Secretary

DARTMOUTH COLLEGE

THE AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

THE fourth annual meeting of the American Institute of Chemical Engineers was held in Washington, D. C., December 20–23.

The reports of the various officers for the year were read, and a very gratifying growth in membership was shown. New officers for the year were elected as follows:

President—Dr. L. H. Baekeland. *Second Vice-president*—Dr. T. B. Wagner. *Third Vice-president*—Professor M. C. Whitaker; the first vice-president being Dr. Eugene Haanel. *Treasurer*—Dr. F. W. Frerichs. *Secretary*—Dr. John C. Olsen. *Auditor*—Mr. G. W. Thompson. *Directors*—Messrs. A. C. Langmuir, H. S. Miner and A. Bement.

The following papers were read at the Wednesday morning session:

"The Hardening of Plasters and Cements and a Simple Chronographic Apparatus for Recording Set," Dr. Chas. F. McKenna. A very ingenious as well as simple instrument for measuring and recording this important property of cements was shown and explained by Dr. McKenna.

"Advances in Testing Explosives," Clarence Hall.

"Distribution of Power in Portland Cement Manufacture," Richard K. Meade.

"Problems in the Manufacture of C.P. Acids," J. T. Baker.

"Combustion of Pulverized Coal," L. S. Hughes.

"Manufacture of Gelatin," Ludwig Thiele.

During the afternoon the institute visited the Bureau of Standards and inspected the standardization of weights and measures, adjustment of pyrometers, thermometers, pressure gauges and similar instruments, as well as the liquid air apparatus. Every one was impressed by the very excellent work being done by this important government bureau.

In the evening the retiring president, Dr. F. W. Frerichs, presented three papers illustrating the solution of problems in chemical engineering practise as follows: "Manufacture of Chloroform from Alcohol," "Construction of Laboratory Apparatus," "Manufacture and Testing of Shipping Cylinders for Liquid Ammonia." The paper on the "Manufacture of Chloroform from Alcohol" was especially interesting, as it showed that by the use of denatured, duty-free alcohol, chloroform could be manufactured from alcohol under present conditions and sold at a profit. The paper on "Manufacture and Testing of Shipping Cylinders for Liquid Ammonia Gas" was supplemented by the paper on "Manufacture and Testing of Carbonic Acid Cylinders," by John C. Minor, Jr. By means of lantern slides the method of testing cylinders was shown, as well as the results of exploding such cylinders under fixed conditions.

On Thursday, the institute visited the United States naval proving grounds at Indian Head, Md. This proved one of the most interesting excursions of the meeting. Four shots were fired from a twelve-inch gun. The method of loading, testing the pressure developed in the gun and velocity of the bullet were shown and inspected with the greatest of interest.

The plants for contact sulphuric acid, nitric acid, the manufacture of ether, nitration of cellulose, powder presses, recovery drying, as well as the testing of the raw materials and finished product were inspected with the greatest of interest.

In the evening a subscription dinner was held at the New Willard Hotel. Addresses were made by Patent Commissioner Moore, Dr. Harvey W. Wiley and Admiral N. C. Twining.

On Friday morning the institute listened to a number of very able speakers on the United States patent system. A symposium had been arranged for the purpose of bringing out defects in the present system and recommendation of the remedies to be applied. The following papers had been prepared and were presented:

"The United States Patent Office," E. B. Moore, Patent Commissioner, U. S. Patent Office.

"Protection of Inventions by Patents. Existing Defects and Remedies Therefor," Walter D. Edmonds, of Edmonds & Peck.

"The United States Patent System," R. N. Kenyon, of Kenyon and Kenyon.

It was the consensus of opinion that the present methods for granting of patents in use at the United States Patent Office are better than any in use by any government in the world. The deplorable condition at the Patent Office on account of congestion and overcrowding due to the failure of the congress to provide suitable quarters for this most important government office, was brought out not only in the papers, but in the visit to the Patent Office during the afternoon. This condition prevails in spite of the fact that the patent bureau has been operated with such economy that a surplus of seven million dollars has accrued during its operation from excess of income from patent fees over expenditures.

It was also brought out that the most serious defects in our present patent system are met by the inventor after his patent has been granted. Intolerable delays occur, and enormous expense is involved in patent litigation, so that in numerous cases the patentee who does not have the strongest financial backing is defrauded of his rights by wealthy and powerful corporations. The remedy suggested for this condition of affairs consists in the establishment of a patent court in which all patent cases will be held, and also the hearing of all testimony in such cases in open court instead of before a referee.

On Friday afternoon the educational discussion which has been carried on at various meetings of the institute was continued, and the committee on education was requested to formulate the opinion of the institute on this important question and transmit copies of same to the universities and technical schools in the United States giving chemical engineering education.

On Friday evening, a paper was read by Mr. F. G. Wheeler on the "Adaptation of the Centrifugal Pump to Chemical Service." A complete discussion of the theories of the pump and all designs and makes with their behavior under operating conditions was given. The pump was illustrated with numerous lantern slides giving views of the pumps discussed.

A number of members of the institute visited on Saturday the steel plant at Sparrows Point, Baltimore, and the cement plant of the Tidewater Portland Cement Co.

The attendance at the meeting was excellent, and general satisfaction expressed at the results accomplished.

J. C. Olsen,
Secretary

Polytechnic Institute,
Brooklyn, N. Y.